

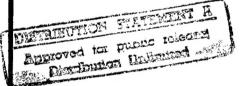
PROGRAMMING DOCUMENTS

ENERGY ENGINEERING ANALYSIS PROGRAM

LIMITED ENERGY STUDY

FORT HUNTER LIGGETT, CALIFORNIA 1993

VOLUME IV



19971016 195

PREPARED FOR

DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT, CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

PREPARED BY

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CONTRACT NO. DACA 05-C-92-0155

DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS P.O. BOX 9005

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Marie Wakeffeld, Librarian Engineering

EEAP, Limited Energy Study Fort Hunter Liggett, California

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1. COMPONENT	FY 1995 MILITARY CONS	CTDUCTION DDOUGCT I	DATA	2. DATE
Army	FI 1995 MILITARI CONS	SIRUCTION PROJECT	JAIA	June 1993
3. INSTALLATION AND	LOCATION	4. PROJECT TITLE		
Fort Hunter	Liggett, California	ECIP Facility Er	ergy Im	provements
5. PROGRAM ELEMEN	6. CATEGORY CODE	7. PROJECT NUMBER	8. PRO	JECT COST (\$000)
	80000			900.6

2. DATE

9. COST ESTIMATES

			Unit	Cost
Item	U/M	Quantity	Cost	(\$000)
Primary Facility				717.79
Insulate ceilings and roofs	LS	_	_	(18.9)
Install duty cycling controls	LS	_	_	(26.2)
Replace heating system pipe insulation	LS	_		(2.1)
Install programmable thermostats	LS	_	_	(60.7)
Replace inefficient chillers	LS	_	_	(363.8)
Install automatic-draft dampers on space heating boilers	LS	-	_	(11.9)
Retrofit to variable air volume	LS	_	_	(111.2)
Replace inefficient boilers	LS	_	-	(25.5)
Insulate domestic hot water piping	LS	_	_	(0.6)
Insulate hot water storage tanks	LS	-	-	(4.1)
Install metering faucets and flow restrictors	LS	-	_	(1.2)
Recover heat from dishwasher hot water	LS	_	-	(5.3)
Install automatic draft dampers on DHW heaters	LS		_	(1.6)
Replace incandescent lighting with fluorescent	LS	-	_	(34.2)
Improve power factor	LS	_	-	(50.4)
Supporting Facilities				0
Estimated Contract Cost				717.7
Contingency (10%)				71.8
Subtotal				789.5
Supervision, Inspect and Overhead (5.5%)				43.4
Unescalated CWE				832.9
Escalation to FY 1995				67.7
Total Request				900.6

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Perform the following energy conservation and cost saving retrofits:

- Install batt insulation in ceilings of 9 bldgs (Energy Conservation Opportunity [ECO] A4).
- Install duty cycling controls (programmable controllers) in 9 buildings (ECO B1). b.
- Insulate hot water heating and cooling water piping in 12 buildings (ECO B4). c.
- Install 24-hour programmable thermostats in 28 buildings (ECO B6/B7). d.
- Replace chillers with more efficient systems in 10 buildings (ECO B8). e.
- Install automatic-draft dampers on space heating equipment in 20 buildings (ECO B10). f.
- Convert multizone air-handling system to variable air volume in 5 barracks bldgs (ECO B15).
- Replace boilers with high-efficiency units in 7 buildings (ECO B21). h.
- Insulate domestic hot water piping in 6 buildings (ECO C2). i.
- Insulate 16 domestic hot water storage tanks in 13 buildings (ECO C3). j.
- k. Install self-metering lavatory faucets in 3 buildings; and install lavatory and shower flow restrictors in 2 buildings (ECO C5).
- Install dishwasher heat recovery unit in Building 206 (ECO C8). 1.
- Install automatic-draft dampers on domestic hot water heaters in 3 buildings (ECO C9).
- Replace incandescent lighting fixtures with fluorescent fixtures in 9 buildings (ECO D4).
- Install automatic power factor correction equipment at utility metering point. Install power factor correction capacitors on 10 HP and larger motors in 6 buildings (ECO D8).

DD FORM 1391

PROJECT: Implement energy conservation retrofits in 44 buildings. (Current mission)

<u>REQUIREMENT</u>: This project will contribute toward achieving Department of Defense facility energy goals of a 20-percent reduction in energy use per gross square feet by FY2000 versus FY1985 baseline levels.

This project will save \$124,184 annually, resulting in a 5.9-year simple payback and a savings to investment ratio of 2.25. The annual energy savings is 2,188 MBTU of electricity, 3,277 MBTU of fuel oil and 4,242 MBTU of propane. All buildings and retrofit actions will be in active use throughout the amortization period.

<u>CURRENT SITUATION</u>: Unnecessary energy is currently being consumed for space heating and cooling systems, lighting systems, and generation of domestic hot water in facilities.

<u>IMPACT IF NOT PROVIDED</u>: If this project is not accomplished, an annual energy and operations and maintenance expense of \$124,184 that could be avoided will be incurred.

<u>ADDITIONAL</u>: This project has been coordinated with the installation physical security plan, and no security improvements are required. This project incorporates recommendations of an Energy Engineering Analysis Program Limited Energy Study performed under Contract No. DACA05-92-C-0155.

Estimated Construction Start: July 1995 Index: 2049
Estimated Midpoint of Construction: September 1995 Index: 2062
Estimated Construction Completion: November 1995 Index: 2075

LOCATION: Fort Hunter Liggett, California

PROJECT TITLE: ECIP Facility Energy Improvements

Detailed Justification

- 1. GENERAL: The project is a significant part of Fort Hunter Liggett's effort to achieve a 20-percent reduction in energy consumption by FY2000 versus FY1985 baseline levels.
- 2. ACCOMMODATIONS NOW IN USE: Not applicable.
- 3. ANALYSIS OF DEFICIENCY: Present system designs within the facilities proposed for retrofits account for a 14-percent loss of the total energy supplied to Fort Hunter Liggett. This translates into an additional annual cost of \$124,184.
- 4. CONSIDERATION OF ALTERNATIVES: The retrofits included in this project represent all of the economically justified actions potential energy conservation opportunities (ECO's) evaluated in the Limited Basewide Energy Study that comply with ECIP criteria.
- 5. CRITERIA FOR PROPOSED CONSTRUCTION: Design and construction will be in accordance with criteria established in DOD 4270.1-M and TM810-5.
- 6. PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT: Not applicable.
- 7. DISPOSAL OF PRESENT ASSETS: Not applicable.
- 8. SURVIVAL MEASURES: Not applicable.
- 9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES: Atmospheric emissions will be reduced because less fuel will be burned as a result of implementation of this project.
- 10. EVALUATION OF FLOOD HAZARDS AND ENCROACHMENT ON WETLANDS: Not applicable.
- 11. ECONOMIC JUSTIFICATION: In accordance with Energy Conservation Investment Program (ECIP) Guidance dated November 1992, an economic analysis has been prepared. Life-cycle cost analysis results are summarized as follows:

•	Estimated Construction Cost (including SIOH) \$832,900
•	Annual Energy Savings 9,707 MBTU
•	Total First Year Dollar Savings \$124,184
•	Discounted Energy Savings \$1,526,854
	Discounted Nonenergy Savings \$366,821
	Total Net Discounted Savings \$1,893,675
	Savings-to-Investment Ratio 2.25

Date: June 1993

LOCATION: Fort Hunter Liggett, California

PROJECT TITLE: ECIP Facility Energy Improvements

Date: June 1993

Refer to "Detailed Calculations" for backup data.

- 12. UTILITY AND TELECOMMUNICATIONS SUPPORT: Not applicable.
- 13. PROTECTION OF HISTORIC PLACES AND ARCHEOLOGICAL SITES: Review procedures have been implemented for this project in accordance with 36 CFR 800. The review has established that there will be no effect.
- 14. PROJECT DEVELOPMENT BROCHURE: A Project Development Brochure (PDB-1) dated July 1993 has been prepared.
- 15. ENERGY REQUIREMENTS: Not applicable.
- 16. PROVISION FOR THE HANDICAPPED: Not applicable.
- 17. REAL PROPERTY MAINTENANCE ACTIVITY ANALYSIS: Not applicable.
- 18. COMMERCIAL ACTIVITIES: This project involves replacement or modification of existing systems for energy conservation. Under these conditions, the provisions of AR 5-XX do not apply, and a "new start or expansion" is not required.

LOCATION: Fort Hunter Liggett, California PROJECT TITLE: ECIP Facility Energy Improvements

DETAILED CALCULATIONS

Date: June 1993

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

TOTAL PROJECT

		Fort Hunter Ligge Facility Energy Impo me: Total Project			Region No. 4			Project No. Fiscal Year FY95
Analysis Da				٠	Economic Life:		YEARS YEARS	Preparer: KELLER & GANNON
1. Investme	nt Costs							
A. Construc	tion Cos	sts			\$789,542			
B. SIOH					\$43,425			
C. Design C					\$47,373	=		
D. Total Co					\$880,339		¢0	
		Existing Equipmen	it				\$0 (\$38,033)	_
G. Total Inv	•	npany Rebate					(\$36,033)	
G. Iotal inv	esuneni	(ID-IE-IF)						\$642,300
2. Energy S	avings (+)/Cost(-):						
Date of NIS	TIR 85-3	273-X Used for Dis	count Factors:	Oc	tober 1992	•		
Energy	N	Cost	Saving		Annual \$		Discount	Discounted
Source	Yrs	\$/MTBU/(1)	MBTU/YR(2)		Savings(3)		Factor(4)	Savings(5)
	00.14	#04.04	00.4		¢4 700		14.50	#00.000
A. Elec.	20 Yr	\$21.84	82.1		\$1,792		14.53	\$26,036
	15 Yr	\$21.84	1,200.5		\$26,217		11.70	\$306,735
	15 Yr	\$18.23	905.7		\$16,510		11.70	\$193,168
B. Dist	20 Yr	\$4.98	0.0		\$0 -		17.63	\$0
	15 Yr	\$4.98	3,276.8		\$16,318		13.78	\$224,864
C. Propane	20 Yr	\$7.87	211.7		\$1,666		18.59	\$30,979
	15 Yr	\$7.87	4,030.0		\$31,716		14.16	_ \$449,092
D. Demand	20 Yr	\$108.60	2.3	kW	\$247		14.53	\$3,593
	15 Yr	\$108.60	230.1	kW	\$24,990		11.70	_ \$292,383
E. Other			· · · · · · · · · · · · · · · · · · ·					
F. Total			9,706.7		\$119,456			\$1,526,854
3. Non Ener	gy Savii	ngs (+) or Cost (-):						
A. Annual R	ecurring	(+/-)			\$6,480	20	Year Life	
					(\$1,752)	15	Year Life	
(1) Discoun	t Factor	(Table A)			-		13.59	_ 20 Year Life
							11.12	15 Year Life
(2) Discoun	ted Savi	ngs/Cost (3A x 3A1)				20 Year Life:	\$88,063

15 Year Life:

(\$19,486)

Life Cycle Cost Analysis Summary TOTAL PROJECT Energy Conservation Investment Program (ECIP)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Saings(+)Cost(-)	•
a. b. c. d. Total	\$107,993 \$221,264 \$30,885 \$360,142	3 5 10	0.89 0.82 0.67	\$96,114 \$181,437 \$20,693 \$298,243	
C Total Non Energ	y Discounted Savin	ngs (3A2+3Bd4)		\$366,821	
 Simple Payback Total Net Discout Savings to Investance Adjusted Internation 	inted Savings (2F5	+3C): i/1G:	e)):	5.9 \$1,893,675 2.25 9.78%	Years

SUMMARY OF DD1391 ENERGY SAVING PROJECT ELEMENTS

A4

ECO	Energy Sa	vings (Mi	llion BTU/	Year)		Annual Er	ergy Cost	Savings (\$/Year)	
No.	Elec Use	Elec kW	Fuel Oil	Propane	Total	Elec Use	Elec Dem	Fuel Oil	Propane	Total
A4	35.4	0.0	0.0	211.7	247.1	\$774	\$0	\$0	\$1,666	\$2,441
B1	0.0	43.5	0.0	0.0	0.0	\$0	\$4,729	\$0	\$0	\$4,729
B4	0.1	0.0	60.6	32.2	92.9	\$1	\$0	\$302	\$253	\$556
B6/B7	686.9	0.0	2,460.0	3,223.3	6,370.2	\$15,001	\$0	\$12,251	\$25,367	\$52,619
B8	353.7	164.1	0.0	0.0	353.7	\$7,724	\$17,821	\$0	\$0	\$25,545
B10	0.0	0.0	282.8	174.3	457.1	\$0	\$0	\$1,408	\$1,372	\$2,780
B15	863.6	0.0	0.0	0.0	863.6	\$15,743	\$0	\$0	\$0	\$15,743
B21	0.0	0.0	0.0	506.1	506.1	\$0	\$0	\$0	\$3,983	\$3,983
C2	0.0	0.0	35.1	14.9	50.0	\$0	\$0	\$175	\$117	\$292
C3	9.2	0.0	48.3	46.1	103.6	\$168	\$0	\$240	\$363	\$771
C5	32.9	0.0	0.0	2.1	35.0	\$600	\$0	\$0	\$17	\$617
C8	0.0	0.0	339.0	0.0	339.0	\$0	\$0	\$1,688	\$0	\$1,688
C9	0.0	0.0	51.0	31.0	82.0	\$0	\$0	\$254	\$244	\$498
D4	159.8	22.5	0.0	0.0	159.8	\$3,491	\$2,439	\$0	\$0	\$5,930
D8	46.6	2.3	0.0	0.0	46.6	\$1,018	\$247	\$0	\$0	\$1,265
Total	2,188	232	3,277	4,242	9,707	44,519	25,237	16,318	33,382	119,456

Descriptions of ECO's

Insulate Ceilings and/or Roofs

- B1 Install Duty Cycling Controls B4 Replace Heating System Pipe Insulation Install Time Clocks & Programmable Thermostats B6/B7 В8 Replace Inefficient Chillers
- B10 Install Automatic Flue Dampers on Heating System Boilers B15
- Convert Multizone HVAC Systems to Variable Air Volume
- B21 Replace Inefficient Boilers
- C2 Replace Pipe Insulation on Domestic Hot Water Systems
- C3 Insulate Hot Water Storage Tanks
- C5 Reduce Domestic Hot Water Flow at Shower Heads and Faucets
- C8 Dishwasher Heat Recovery
- C9 Install Automatic Flue Dampers on DHW Systems
- D4 Replace Incandescent Lighting with Fluorescent
- D8 Improve Power Factor

SUMMARY OF DD1391 ENERGY SAVING PROJECT ELEMENTS

ECO	Life Cycle	Energy Co	st Savings			Non-Energy S	avings	Other
No.	Elec Use	Elec Dem	Fuel Oil	Propane	Total	Annual \$/Yr	LCC\$	LCC Savings
A4	\$11,248	\$0	\$0	\$30,979	\$42,226	\$0	\$0	\$0
B1	\$0	\$55,334	\$0	\$0	\$55,334	(\$536)	(\$5,960)	\$0
B4	\$13	\$0	\$4,157	\$3,583	\$7,754	(\$38)	(\$420)	\$0
B6/B7	\$175,512	\$0	\$168,816	\$359,202	\$703,533	(\$1,689)	(\$18,781)	\$0
B8	\$90,371	\$208,508	\$0	\$0	\$298,880	\$0	\$0	\$298,243
B10	\$0	\$0	\$19,408	\$19,423	\$38,830	\$0	\$0	\$0
B15	\$184,188	\$0	\$0	\$0	\$184,188	(\$1,000)	(\$11,120)	\$0
B21	\$0	\$0	\$0	\$56,397	\$56,397	\$0	\$0	\$0
C2	\$0	\$0	\$2,409	\$1,660	\$4,069	\$0	\$0	\$0
СЗ	\$1,962	\$0	\$3,311	\$5,134	\$10,407	\$0	\$0	\$0
C5	\$7,017	\$0	\$0	\$239	\$7,256	\$0	\$0	\$0
C8	\$0	\$0	\$23,263	\$0	\$23,263	(\$160)	(\$1,779)	\$0
C9	\$0	\$0	\$3,500	\$3,455	\$6,954	\$0	\$0	\$0
D4	\$40,839	\$28,542	\$0	\$0	\$69,381	\$1,671	\$18,578	\$0
D8	\$14,788	\$3,593	\$0	\$0	\$18,381	\$6,480	\$88,063	\$0
Total	\$525,939	\$295,976	\$224,864	\$480,071	\$1,526,854	\$4,728	\$68,581	\$298,243

Descriptions of ECO's

A4	Insulate Ceilings and/or Roofs
B1	Install Duty Cycling Controls
B4	Replace Heating System Pipe Insulation
B6/B7	Install Time Clocks & Programmable Thermostats
B8	Replace Inefficient Chillers
B10	Install Automatic Flue Dampers on Heating System Boilers
B15	Convert Multizone HVAC Systems to Variable Air Volume
B21	Replace Inefficient Boilers
C2	Replace Pipe Insulation on Domestic Hot Water Systems
СЗ	Insulate Hot Water Storage Tanks
C5	Reduce Domestic Hot Water Flow at Shower Heads and Faucets
C8	Dishwasher Heat Recovery
C9	Install Automatic Flue Dampers on DHW Systems
D4	Replace Incandescent Lighting with Fluorescent
D8	Improve Power Factor

SUMMARY OF DD1391 ENERGY SAVING PROJECT ELEMENTS

ECO	Investment Co:	sts			Economic	Evalua	tion
No.	Construction	Total	PG&E Rebate	Investment	Payback	SIR	AIRR
A4	\$20,777	\$23,166	\$0	\$23,166	9.5	1.82	7.17%
B1	\$28,795	\$32,106	(\$200)	\$31,906	7.6	1.55	7.03%
В4	\$2,359	\$2,630	\$0	\$2,630	5.1	2.79	11.36%
B6/B7	\$66,786	\$74,467	(\$13,500)	\$60,967	1.2	11.23	22.20%
В8	\$400,158	\$446,176	(\$19,688)	\$426,488	8.6	1.40	6.36%
B10	\$13,059	\$14,561	\$0	\$14,561	5.2	2.67	11.03%
B15	\$122,292	\$136,355	\$0	\$136,355	9.2	1.27	5.67%
B21	\$28,061	\$31,288	\$0	\$31,288	7.9	1.80	8.17%
C2	\$655	\$730	\$0	\$730	2.5	5.57	16.62%
СЗ	\$4,578	\$5,105	\$0	\$5,105	6.6	2.04	9.06%
C5	\$1,326	\$1,478	\$0	\$1,478	2.4	4.91	15.64%
C8	\$5,839	\$6,510	\$0	\$6,510	4.3	3.30	12.62%
C9	\$1,712	\$1,909	\$0	\$1,909	3.8	3.64	13.36%
D4	\$37,630	\$41,957	(\$4,645)	\$37,312	4.9	2.36	10.12%
D8	\$55,515	\$61,899	\$0	\$61,899	8.0	1.72	6.86%
Total	\$789,542	\$880,339	(\$38,033)	\$842,306	5.9	2.25	-

Descriptions of ECO's

A4	Insulate Ceilings and/or Roofs
B1	Install Duty Cycling Controls
B4	Replace Heating System Pipe Insulation
B6/B7	Install Time Clocks & Programmable Thermostats
B8	Replace Inefficient Chillers
B10	Install Automatic Flue Dampers on Heating System Boilers
B15	Convert Multizone HVAC Systems to Variable Air Volume
B21	Replace Inefficient Boilers
C2	Replace Pipe Insulation on Domestic Hot Water Systems
C3	Insulate Hot Water Storage Tanks
C5	Reduce Domestic Hot Water Flow at Shower Heads and Faucets
C8	Dishwasher Heat Recovery
C9	Install Automatic Flue Dampers on DHW Systems
D4	Replace Incandescent Lighting with Fluorescent
D8	Improve Power Factor

FACILITY AND RETROFIT SUMMARY

Fac		Category	Area				ENERGY CONSERVATION OPPORTUNITY NUMBER	V CO	NSER	VATIC	MON	THO	LIN	Z	3FB			
Š	Installation Name	Code	(SF)	A-4	B-1	B-4	B-6/7	B-8	B-10	B-10 B-15 B-21	B-21	C-2	533	5	S.C.	0.0	4	å
S 79	Post Office, Main	73073	1.000								_						5	2
P 80	Exchange, Main Retail	74053	9,093	•	•	•	•		•		,		•		•		. (
P 81	Theater with Dressing Rm's	74076	6,719	,	,	, ,	, ,		•	,	1		•					
P 101	Hacienda	74046	22,211	4	•		•	•	•	,	•	•	•			•		,
P 116		74052	1,788	•	•	•	•	, ,	, ,	•	, ,	•	,)	•	•
T 120	Fire Station	74034	9,600	•	•	•		•	•	•			•	•			•	
T 121	Bowling Center	74011	5,580	•	•	•	•	•	, .	•	•	•	,					
T 127	Officers Quarters Military	72410	2,250	•	•	•	•	•		,	•	•	•	•				
P 128	Officers Quarters Military	72410	20,196	•	•	•	•	•	•	,	•		,	•		•		
S 144	_	74034	7,172	•	•	•		, ,	, ,	•	•							
S 146		21920	4,042	•	,		•	•			,					•		
T 156	FE Facility - Shop/Office	21920	2,250	•	•			•		•	,			' '			•	,
T 158	Vehicle Storage	44262	1,859	'	•	,	•	•		•)	
T 161	Admin General Purpose	61050	2,250	•	•	•	•	•		,		•		•	•		• •	
T 162	Elec Maint. Shop	21710	2,250	•	•	•	•	,	•	•	,	•	•	•	,			
<u></u>	Officers Quarters Military	72410	2,250	•	'	•	•	•	•	'		_	•	•	_			
T 164	Admin General Purpose	61050	2,250	•	•	•	•	•	•	,	•		-					
T 165	Admin General Purpose	61050	2,250	•	•		•	•	•	•	•		_		, ,	,		
	Officers Quarters Military	72410	2,250	•			•		_	•	•	,	•				•	•
_	Officers Quarters Military	72410	2,250	•	•		•	,		,	,		,				, ,	
_	General Purp Warehouse	44220	6,560		•			•	•	,			-					
_	Cold Storage Warehouse	43210	800	•	•	_	,	•	•	•		_					,	
	Technical Library	61065	3,599	•	,	•	•	•	•		•	•		, ,	. ,		,	
	Child Development Cntr	74047	3,599	•	•	,	•	-	•	,	•			, ,				•
	Commissary	74021	3,000	•	•	,	•		•		,		, ,					
_	Sup Svc Admin Bldg	61023	1,920	•			•		_			,			. ,			•
_	Post Chapel	73017	2,720	,	•	•			_		•		_	_				
_	Admin Bldg R&D	61060	7,728	•	•	•	•		•		•	-	•	•		. ,		,
	General Inst Bldg	171120	1,090	,	•		_					-,	, ,	_				,
205	Admin General Purpose	61050	40,981		•		•	•	•	•				. ,	. ,			. (
	Enlisted Pers Dining Fac	72210	16,768	,	•	•	,) '					_		_)
_	Enl Barracks w/o Dining	72111	35,820	•	•	•	•	•	•	•		•) '		_		_	. (
_	Enl Barracks w/o Dining	72111	40,981		•	•	•) (
	AAFES Snack Bar	74062	3,320		•	•	•		, .	, ,								-
_	Hith/Dntl Clinic w/ Beds	55040	10,973	•	_				•			-	_	. ,			_	. (
	Outdoor Swimming Pool	75030	•		•		_			•		_	_	. ,)
	Gymnasium	74034	8,907		_	_	•											
P 219 P	Physical Fitness Center	74028	3,212	•	_	_		_		-	_				_			
		•		-	-	-	_	-	-	_	_	_	-	_	_	_	_	-

ECO recommended for this building

FACILITY AND RETROFIT SUMMARY

Fac		Category	Area				ENERGY CONSERVATION OPPORTUNITY NUMBER	3Y CC	NSE!	∛ATIK	ON OP	PORT	TINO	NOM	BER			
2	Installation Name	Code	(SF)	A 4	<u>-</u>	84	B-6/7	B-8	B-10	B-15	B-21	C-2	C-3	C-5	C-8	6-O	4	0-8
		79111	40.015		•	•	•	•	•	•		•					•	•
677	P 229 EIII Dallachs W/O Dilling	171	200) () (•	•		•					•	•
P 230	Ent Barracks w/o Dinting	72111	40,981		•	Ð	•	•	•			•	•	,))
\$ 235	S 235 Admin General Purpose	61050	3,000	•	•		•	•	'	•	•		•	•	•	•		,
\$ 236	S 236 Admin General Purpose	61050	3,000	•	,	•		٠	'			•	•		,	•		
\$ 237	Admin General Purpose	61050	3,000	•	•	,	•	•	•	•	•	•	•	•		•	• (
\$ 238	Sig Photo Lab	14130	14,548	•	•	•	,	•	•	•	•	•	•	٠	•	•	•	
P 240	Admin General Purpose	61050	3,000	•		,	•	٠	٠	,	٠	•	•	,		•	•	
S 241	GM Facility	31220	10,000	•	'	•	•	•	•	•	•	•	•	•		•	•	1
S 243	Admin General Purpose	61050	3,000	•	•		•	•	•	•	•		٠	•	ı	•	•	1
S 244	Admin General Purpose	61050	3,000	٠	•	•	•,	•	٠	•	•	٠		•		•	•	•
S 246	Admin General Purpose	61050	3,000	,	,	,	•	,	•	•	٠		•	٠	•	•		
S 247	Admin General Purpose	61050	3,000	'	•	٠	•	•	•	•	•	٠	•	•	•		•	
P 252	P 252 Vehicle Maint Shop DS	21420	12,299	,	•	•	,	•	•	•		٠	•		!	•	•	
P 256	Vehicle Maint Shop ORG	21410	5,294	•	•	•	•	1	•	•	1	٠	•	,	•	•	•	•
P 259	P 259 Vehicle Maint Shop ORG	21410	13,667	•	•	•	•	•	•	,	•	•	•	•	,		•	
S 283	FE Maintenance Shop	44220	4,000	•	•	•	•	٠	٠	•	٠	٠	٠	•	1		•	
\$ 286	S 286 Admin General Purpose	61050	3,000	•	٠		•	•	•	•	•	٠	•	•	•		•	
P 287	Recreation Building	74069	5,584	•	•	•	•	٠	<u>.</u>	•	•	٠	•	٠	•		'	
\$ 288	S 288 General Purpose Warehous	44220	3,000	•	•	•	•	•	•	•	•	•	•	•	•	٠		
S 290	Electron Equip Facility	31740	14,856	•		•	•	•	•	•	•	•	•	•	•		•	,
S 291	Cont Humid Warehouse	44230	7,400	,	•	•	•	•	•	•	•	•		1	•	•	•	
P 295	Enl Barracks w/o Dining	72111	46,593		•	•	•	•	•	•	•	•	•	•	•	•	•	
P 301	ADP Building	61031	10,800	•	•		•	•	•	•	•	•	٠	•		•	•	
P 642	Detached Latrine/Shower	72324	992	•	•	•	•	•	•	•	•	١	•	,	•	'	•	•
\$ 220	S 220 Control Tower - Range SPT	17123	891	•	•	•	•	•	٠	'	٠	٠	•	٠	•	•	,	

ECO Number / Description

- Reduce Domestic Hot Water Flow at Shower Heads and Faucets Insulate Hot Water Storage Tanks Dishwasher Heat Recovery B-21 C-5 6000 6000 6000 6000 6000 Install Time Clocks & Programmable Thermostats Replace Heating System Pipe Insulation Insulate Ceilings and/or Roofs Install Duty Cycling Controls Replace Inefficient Chillers B-6/7 B4 8-8
 - install Automatic Flue Dampers on Heating System Bollers Convert Multizone HVAC Systems to Variable Air Volume B-10
- Replace Inefficient Boilers
- Replace Pipe Insulation on Domestic Hot Water Systems
- install Automatic Flue Dampers on DHW Systems
 - Replace Incandescent Lighting with Fluorescent Improve Power Factor

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

ECO A4

Location:	Fort Hunter Li	ggett, California	Region No. 4			Project No.
Project Title:		ergy improvements				Fiscal Year FY95
Discrete Portion	Name: ECO A4	Insulate Ceilings an	d/or Roofs			
Analysis Date: J	lune 1993		Economic Life:	20	YEARS	Preparer: KELLER & GANNON
1. Investment Co	sts					
A. Construction	Costs		\$20,777			
B. SIOH			\$1,143			
C. Design Cost			\$1,247			
D. Total Cost (1/	1+1B+1C)		\$23,166	•		
E. Salvage Value	of Existing Equ	ipment			\$0	
F. Public Utility C	Company Rebate				\$0	
G. Total Investm	ent (1D-1E-1F)					\$23,166
2. Energy Saving	gs (+)/Cost(-):					
		or Discount Factors:	October 1992			
Energy	Cost	Saving	Annual \$		Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)		Factor(4)	Savings(5)
000.00	Ψ/···· = -/(·/	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	• • • • • • • • • • • • • • • • • • • •		()	3 ()
A. Elec.	\$21.84	35.4	\$774		14.53	\$11,248
B. Dist	\$4.98	0.0	\$0		17.63	\$0
C. Propane	\$7.87	211.7	\$1,666		18.59	\$30,979
D. Demand	\$108.60	0.0 kW	\$0		14.53	\$0
E. Other						• -
F. Total			\$2,441	=		\$42,226
1.70			+ = · · · ·			· · · · · · · · · · · · · · · · · · ·
3. Non Energy S	avings (+) or Co	ost (-):				
o. Hon Energy o	aviiigo (1) oi o o			•		
A. Annual Recur	ring (+/-)		\$0			
(1) Discount Fac				•	13.59	
	Savings/Cost (3A	x 3A1)				\$0
(Z) Disocurited C	avii igo, o ooc (o, c	X 0/ 1.1 /				40
R Non Recurring	g Savings (+) or	Cost (-)				
D. NOT Neculting	g cavings (1) or	0001()				
Item	Savings(+)	Year of	Discount		Discounted Sa	IV-
Item	Cost(-)(1)	Occur. (2)	Factor(3)		ings(+)Cost(-)	
	0031(-)(1)	000dr. (2)	1 40(0)		1195(1)0051()	(7)
a.						
b.			-			
c. d. Total				=		
d. Total						
O Tatal Nam Eng	Diagnumted (Savinga (2A0±2Bd4)	`		\$0	
C Total Non Ene	ergy Discounted (Savings (3A2+3Bd4)		Φ0	
4 Cimple Dayle	ok 1G//0E2±24	L/3Rd1/Economic Li	fo)):		0.F	Voore
		+(3Bd1/Economic Li	ie)).		9.5	Years
	ounted Savings				\$42,226	
	restment Ratio (S				1.82	
7. Aajustea inter	nal Rate of Retur	TI (AIRR):			7.17%	

ECO A4: INSULATE CEILINGS AND/OR ROOFS

Buildings without ceiling or roof insulation are considered. Buildings considered are listed in the attached calculations.

Energy savings are based on a TRANE-TRACE computer simulation run on a 1,000 SF "Model" structure for Fort Hunter Liggett. (See attached) Energy savings are determined on a roof/ceiling square foot basis as follows:

Cooling Load and Electric Savings

Baseline =	68,596	BTUH, Load
ECO A-4 Insulation =	57,922	BTUH, Load
Savings =	10,674	BTUH, Load

Assume an EER = 10.0, thus, Electric Energy Savings for buildings with Air Conditioning are =

1.067 Watts / SF

Results are extended on a roof/ceiling SF basis, using the building cooling degree-hour calculation, design inside and outside temperatures as follows:

 $[Roof/Ceiling SF] \times [1.067 \text{ W/SF}] / [1,000 \text{ W/kW}] \times [Bldg \text{ CDHr/Yr}] / [Design \text{ Delta T}] = \text{kWH/Yr Saved}$

Heating Load and Energy Savings

Baseline =	34,440	BTUH, Load
ECO A-4 Insulation =	28,447	BTUH, Load
Savings =	5,993	BTUH, Load

Load Savings are, thus = 5.99 BTUH / SF

Energy Savings are based on the building heating system efficiency. Fuel oil or propane savings are determined by dividing the load savings by the system efficiency and multiplying by the building full load hours per year (determined by dividing the building heating degree hours by the design inside-outside temperature difference).

Construction Cost

Construction costs are estimated based on "Means Construction Cost Estimating Guide 1993" for fiberglass type batt insulation with moisture barrier.

BASELINE, BEFORE ECO A4 IMPLEMENTED

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

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		******	*****	TION DATEOU	PEAK *****	*****	****	****	HAMM CTC :	SPACE P	EAK	HEAT	ING COIL PE	:AK ""	
	eaked at				7/17			*	Ho/I	Hr: 7,	18 *		Mo/Hr: 13/	1	
	Outside A		CAI		6/ 70/ 70.0)		*	CAL	DB: 9'	*		OADB: 27	7	
	Juliside A			,				*			*				
			Space	Ret. Air	Ret. Air	No	t Per	ent *	Spi	ace .	Percnt *	Space Pea	k Coil Pe	eak.	Percnt
		9	ens.+Lat.	Sensible	Latent	Tota	i Of	Tot *	Sensil	ble	Of Tot *	Space Sen		HIS	Of Tot
	Envelope		(Btuh)	(Btuh)	(Btuh)	(Stui	1)	(%) *	(Bti	uh)	(%) *	(Btuh) (Btu	m)	(%)
	Skylite		0	0			0 0	.00 *		0	0.00 *		0	0	0.00
	Skylite		0	0			0 0	.00 *		0	0.00 *		0	0	0.00
	Roof Co		0	14,919		14,91		.75 *		0	0.00 *		0 -7,8		22.93
	Glass S	olar	15,120	0		15,12		2.04 *	16,		35.17 *		0	0	0.00
	Glass C	ond	2,421	0		2,42		.53 *	-	002	4.16 *	-6,29	-		18.27
	Wall Co	and	23,987	6 ,143		30,13		.92 *	24,		50.05 *	-16,47			58.80
	Partiti	on	0					.00 *		0	0.00 *		0	0	0.00
	Exposed	Floor	0				-	.00 *		0	0.00 *		0	0	0.00
	Infiltr	ation	0					.00 *		0	0.00 *		0	0	0.00
	Sub Tot	a(==>	41,528	21 ,062		62,59	90 91	1.24 *	43,	050	89.37 *	-22,76	5 -34,4	140	100.00
	Internal	Loads						*		707			•	•	0.06
	Lights		1,707	0		1,70		2.49 *	•	707	3.54 *		0	0	0.00
	People		4,300			4,30	-	5.27 *	1,	800	3.74 *		0	0	0.00
	Misc		0	0	0			.00 *	-	0	0.00 *		0	0	0.00
	Sub Tot	a(==>	6,007	0	0	6,0		3.76 *	•	506	7.28 *		0	0	0.00
	Ceiling L	.oad	1,961	-1,961				* 00.0	1,	614	3.35 *	-1,10		0	0.00
	Outside /	\ir	0	0	0			0.00 *		0	0.00 *		0	0	0.00
	Sup. Fan	Heat						0.00 *			0.00			0	0.00
	Ret. Fan	Heat		0			_	3.00 *			0.00 *			0	0.00
	Duct Heat	Pkup		0			-	0.00		^	0.00 *		0	0	0.00
	OV/UNDR S	Sizing	0					0.00 *		0	0.00 *		•	0	0.00
	Exhaust I	ieat		0							0.00 *			0	0.00
	Terminal	Bypass		0	0		0 (0.00 *			0.00 ··			•	0.00
						(O. E	04 10	0.00 *	4.2	170	100.00 *	-23,87	3 -34.	440	100.00
	Grand To	ta(==>	49,496	19,100	0	08,3	יטו סיע	J.00 ~	40,	110	100.00	,.	,		10010
				C00	LING COIL SI	ELECTION-									
		Total	Capacity	Sens Cap.	Coil Airfl	Ente	ring D	B/WB/HR	Leav	ing DB	/WB/HR	Gross Tota		8 (sf	(%)
		(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg f	Grains	Deg F	Deg F	Grains	Floor	1,000		
,	iain Clg	5.7	68.6	66.1	3,219	81.1	64.5	66.9	61.2	57 .5	67.2	Part	0		
	ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0		
	pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	1,000		0 (
	otals	5.7	68.6									Wall	1,400	1	40 1
			ue corr cer	ECTION			AIRFLO	⊌S (cfm)	E	NGINEERING	CHECKS	TEMPERA	TURES	(F)
•				ECTION	Lvg	Туре		ling	Heating		% OA	0.0	Туре	Clg	Htg
		Capaci		m) Degif		Vent	-	0	0	-	Cfm/Sqft	3.22	SADB	61.2	74.
		(Mbh	-			Infil		0	0		Cfm/Ton	56 3.16	Plenum	81.2	59.
	lain Htg	-50	•	0 0.0		Supply	3	,219	3,219	_	Sqft/Ton		Return	81.1	60.
	Aux Htg		.0	219 60.7		Hincfm	-	0	0		Btuh/Sqft		Ret/QA	81.1	60.
	reheat			0 0.0		Return	3	,219	3,219		People	10	Runarnd	75.0	68.
	Reheat		.0				•	0	0		% OA	0.0	Fn MtrTD	0.0	0.
	A 2 to 2 months		ı n	0 01	0.0	EXMAUST		U		Hes	, ~				
1	Humidif Opt Vent).0).0	0 0.0		Exhaust Rm Exh		0	0		Cfm/SqFt	3.22	Fn BldTD	0.0	

AFTER ECO A4 IMPLEMENTED

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

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	****	*****	OLING COIL	PEAK *****	*****	****		CLU .	SPACE	PEAK """	annana ME	ATTING COIL P	EAK "	
		(0		7/18			*	Mo/	Hr:	7/18	•	Ho/Hr: 13	/ 1	
eaked at Outside A	Time ==>	OAD		1/ 68/ 70.0			*	CA	DB:	91	•	OADB: 2	7	
Jutside A		0.0	-, ,				*				*			
		Space	Ret. Air	Ret. Air	Net	Percni	t *	Sp	ece.	Percnt	 Space F 	eak Coil P	eak	Percnt
	Sei	ns.+Lat.	Sensible	Latent	Total	Of To	*	Sensi	ble	Of Tot	* Space S	iens Tot S	ens	Of Tot
nvelope		(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Bt	uh)	(%)	* (B1	tuh) (8t	uh)	(%)
Skylite		0	0		0	0.00	*		0	0.00	•	0	0	0.00
Skylite		0	0		0	0.0	*		0	0.00	*	0	0	0.00
Roof Co		0	2,272		2,272	3.9	2 *		0	0.00	*	0 -1,	468	5.16
Glass S		16,940	0		16,940	29.2	5 *	18,	550	39 .05	*	0	0	0.0
Glass (2,002	0		2,002	3.4	6 *	1,	523	3.21	* -6,	,291 -6,	291	22.1
Wall Co		24,108	6,594		30,702	53.0	1 *	23,	224	48 .89	* -16	,474 -20,	688	72.7
Partiti		0			0	0.0	0 *		0	0.00	•	0	0	0.0
Exposed		0			0	0.0	• 0		0	0.00	*	0	0	0.0
Infilt		ō			0	0.0	0 *		0	0.00	*	0	0	0.0
Sub Tot		43,050	8,865		51,915	89.6	3 *	43,	297	91.14	* -2Z	,765 -28,	447	100.0
nternal		,					*				*			
Lights		1,707	0		1,707	2.9	5 *	1,	707	3 .59	*	0	0	0.0
People		4,300			4,300	7.4	2 *	1,	800	3 .79	*	0	0	0.0
Misc		0	0	0	0	0.0	0 *		0	0.00	•	0	0	0.0
Sub To	ta(==>	6,007	0	0	6,007	10.3	7 *	•	506	7.38	•	0	0	0.0
eiling i		812	-812		0	0.0	0 *		704	1.48		-51 5	0	0.0
utside /		0	0	0	0	0.0	0 *		0	0.00	*	0	0	0.0
up. Fan					0					0.00	*		0	0.0
et. Fan			0		C					0.00	*		0	0.0
uct Hea			0		C				_		•	_	0	0.0
V/UNDR	Sizing	0			C				0	0.00	*	0	0	0.0
xhaust	Heat		Ō	0	C					0.00	-		0	0.0
erminal	Bypass		0	0	C	0.0	0 *			0.00			0	0.0
							*			400.00		200 20	,,,	100 1
rand To	tal==>	49 ,868	8,054	0	57 ,92 2	100.0	0 *	47,	,507	100.00	23	,280 -28,	447	100.0
												AREAS-		
				LING COIL SE		AB //	 p/va			B/WB/HR	Gross T) (%
		apacity	•	Coil Airfl		ing DB/W			-	Grains	Floor	1,000	(31	, (*,
	(Tons)	(Hbh)	(Mbh)	(cfm)	Deg F De	-		61.2	57.3		Part	0		
in Clg	4.8	5 7.9	55.4	3,170			66.9	0.0	0.0		ExFlr	0		
x Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		Roof	1,000		0
t Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Wall	1,400	4	140
tals	4.8	57 .9									wait	1,400	1	70
					A1	DEI ALIG	(rfm)			FNGINFERT	NG CHECKS	TEMPER	ATURES	(F)-
			ECTION			Coolin		Heating		g % CA	0.0		Clg	Ht
	Capacity			Lvg	Type		ия О	0		.g Cfm/Sqf			61.2	
	(Mbh)	(cf			Vent		0	0		g Cfm/Ton			77.6	
in Htg	-37.2		170 63.9		Infil	3,17		3,170		g Saft/To			77.5	
x Htg	0.0		0 0.0		Supply	3,17	0	3,170		g Btuh/Sq			77.5	
eheat	-0.0		170 64.2		Mincfm	7 47		3,170		. People	10		75.0	
eheat	0.0		0.0		Return	3,17	0	3,170		g % OA	0.0		0.0	
umidif	0.0		0 0.0		Exhaust		0	0		tg Cfm/SqF			0.0	
pt Vent	0.0		0 0.0	0.0	Rm Exh Auxil		0	0		tg Btuh/Sq				
otal	-37.2	,												

ECO A4 INSULATE CEILINGS / ROOFS

Bldg	Area	Heating	Cooling	Heating Cooling Heating Energy		Use W/Previous EC Energy Use W/ECO-A4	ious EC	Energy Us	Se W/ECC	-A4		Energy Savings	avings	Energy (Energy Cost Savings	gs	
	(SF)	Degree	Degree	Degree Efficienc Electric	Electric	Propane Fuel Oil		Electric Propane Fuel Oil	Propane	Fuel Oil	Electric	Propane	Fuel Oil	Electric	Propane	Fuel Oil	
		Hours	Hours		Kwh/Yr	MBTU/Y	MBTU/Y MBTU/Y	KWH/Yr MBTU/Y MBTU/Y	MBTU/Y	MBTU/Y	Kwh/Yr	MBTU/Y MBTU/Y	MBTU/Y	\$/YR	\$/YR	\$/YR	Total
127	2,250	85,120	21,833	64.0%	2,783	193.1		1,036	154.1	•	1,747	39.0	0.0	\$130	\$307	0\$	\$437
161	2,250	60,531	15,420	72.0%	3,872	1.2		2,638	46.3		1,234	24.7	0.0	\$92	\$194	0\$	\$286
162	2,250	60,531	15,420	72.0%	3,872	11		2,638	46.3		1,234	24.7	0.0	\$92	\$194	0\$	\$286
163	2,250	60,531	15,420	72.0%	3,872	11		2,638	46.3		1,234	24.7	0.0	\$92	\$194	\$0	\$286
164	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3		1,234	24.7	0.0	\$92	\$194	0\$	\$286
165	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3		1,234	24.7	0.0	\$92	\$194	\$0	\$286
166	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3		1,234	24.7	0.0	\$92	\$194	0\$	\$286
167	2,250	60,531	15,420	72.0%	3,872	71		2,638	46.3		1,234	24.7	0.0	\$92	\$194	0\$	\$286
TOTLAS			-								10,385	212	0	\$774	\$1,666	\$0	
				-						•							

ECO A4 COST SAVINGS

1.8	\$42,226	\$23,166	\$20,777					TOTALS
1.7	\$4,946	\$2,896	\$2,597	\$2,361	\$2,338	\$1,798	\$1,665	167
1.7	\$4,946	\$2,896	\$2,597	\$2,361	\$2,338	\$1,798	\$1,665	166
1.7	\$4,946	\$2,896	\$2,597	\$2,361	\$2,338	\$1,798	\$1,665	165
1.7	\$4,946	\$2,896	\$2,597	\$2,361	\$2,338	\$1,798	\$1,665	2
1.7	\$4,946	\$2,896	\$2,597	\$2,361	\$2,338	\$1,798	\$1,665	183
1.7	\$4,946	\$2,896	\$2,597	\$2,361	\$2,338	\$1,798	\$1,665	162
1.7	\$4,946	\$2,896	\$2,597	\$2,361	\$2,338	\$1,798	\$1,665	161
2.6	\$7,603	\$2,896	\$2,597	\$2,361	\$2,338	\$1,798	\$1,665	127
	Savings \$	€9	B×1.10	OHP x 1.01	GC x 1.30	CC x 1.08	Cost (CC) \$	Number
SIR	LCC Energy	Investment	Contingency	Bond	OH & P	Gen Cond	Building Construction Cost	Building
					and the same and t		The same of the sa	

Construction Cost....Bare cost (see cost estimates)

General Conditions......8% of total plus Construction Cost

OH & P......Contractors overhead and profit 30% of Gen Cond plus Gen Cond

Bond.....1% of OH&P plus OH&P

Contingency......Estimators contingency 10% of Bond plus Bond

Investment.......Total Construction Cost (Contingency) plus 5.5% SIOH & 6% for Design

Electricity = 14.5

Propane = 18,59

Fuel Oil = 17.63

SIR.....LCC Savings/Investment

CONSTRUCTION COST ES	TAMITE	E		Date Prepared June 1993	3	Sheet Of	
Project EEAP Limited Energy Study				Project No.	Basis for	! Estimate	
Location Fort Hunter-Liggett, California					Code A	(no design compe	eted)
Engineer-Architect							
Keller & Gannon Drawing No.		Estimat	07		Checked	Rv	
ECO A-4 Insulate Ceilings/Roofs		Louina	.		onconcu :	. ,	
		untity		Labor		Material	
Line Item	No. Units	Meas.	Per Unit	Total	Per Unit	Total	Total Cost
Building 127							
R-19 Batt Insulation	2250	SF	\$0.24	\$540	\$0.50	\$1,125	\$1,665
Subtotal Building 127							\$1,665
Building 161							
R-19 Batt Insulation	2250	SF	\$0.24	\$540	\$0.50	\$1,125	\$1,665
Subtotal Building 161							\$1,665
Building 162 through 167							
R-19 Batt Insulation	2250	SF	\$0.24	\$540	\$0.50	\$1,125	\$1,665
Subtotal Building 162 through 167							\$1,665
Building 252							
R-19 Batt Insulation	12300	SF	\$0.24	\$2,952	\$0.50	\$6,150	\$9,102
Subtotal Building 252							\$9,102
				:			
							-
				-			

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

ECO B-1

	ECIP Facility Er	ggett, California nergy Improvements				Project No. Fiscal Year	FY95
	ate: June 1993	CO B1 Install Duty C	Economic Life:		YEARS	Preparer: KFI i	ER & GANNON
Allalysis D	ate. Julie 1550		Economic Ene.		12,410	Tropulor. REE	LIT & GAITHOIT
1. Investme	ent Costs						
A. Constru	ction Costs		\$28,795				
B. SIOH			\$1,584				
C. Design	Cost		\$1,728				
D. Total Co	ost (1A+1B+1C)	\$32,106				
E. Salvage	Value of Existin	ng Equipment					
F. Public U	Itility Company	Rebate			\$200		
G. Total In	vestment (1D-1E	E-1F)				\$31,906	
	Savings (+)/Cos	st(-): Used for Discount F	actom: Octobe	1	002		
Date of Nic	51H 65-32/3-X	Used for Discount F	actors. Octobe	# 1	992		
Energy	Cost	Saving	Annual \$		Discount	Discounted	
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)		Factor(4)	Savings(5)	
COULCE	Φ/Μ120/(1)	11.07 11 1(2)	54g5(5)			- Cuvgu(e)	
A. Elec.	\$21.84		\$0		11.70	\$0	
B. Dist	\$4.98		\$0		13.78	\$0	
C. Propan	\$7.87		\$0	•	14.16	\$0	
D. Other						•	
E. Demano	@ \$108/kW-Yr	43.5 kW	\$4,729		11.70	\$55,334	
F. Total			\$4,729			\$55,334	_
3. Non Ene	ergy Savings (+) or Cost (-):					
A A	Dags		(AE06)				
	Recurring (+/-)	A\	(\$536)		11.10		
	nt Factor (Table	•			11.12	. (AF 000)	
(2) Discour	nted Savings/Co	ost (SA X SAT)				(\$5,960)	
R Non Rec	curring Savings	(+) or Cost (-)					
D. NOTTHE	culting outlings	(1) 01 0031()					
Item	Savings(+)	Year of	Discount		Discounted Sa	av-	
110111	Cost(-)(1)	Occur. (2)	Factor(3)		ings(+)Cost(-		
	()(.)					,	
a.							
b.						•	
C.			-			•	
d. Total						1	
C Tetal No	n Energy Diego	unted Sovings (2A2	13044)		(\$E 060)		
O TOTAL NO	n energy Disco	unted Savings (3A2	+30U4) -		(\$5, 9 60)		
4. Simple F	Payback 1G/(2F	3+3A+(3Bd1/Econ	omic Life)):		7.6	Years	
		avings (2F5+3C):			\$49,374		
		latio (SIR) 5/1G:			1.55		
_		f Return (AIRR):			7.07%		

ECO B1: INSTALL DUTY CYCLING CONTROLS

Duty cycling controls are installed to reduce the electrical demand charges. HVAC system equipment with fairly constant loading are selected for control. Duty cycling controls are assumed to turn off each device for a period of 10 minutes during each hour. Thus, energy demand charge cost savings are based on 1/6 th of the connected load. Savings are calculated as follows:

Motor Size: HP

Motor Efficiency: Eff%

Motor kW: HP x 0.746 kW/HP / Eff%

New kW (with Duty Cycling): Motor kW x 5 / 6

Electrical Demand Cost Savings per Year: \$108.60 / kW x (Motor kW - New kW)

Economic Life (N): 15 Years

Life Cycle Electrical Demand Cost Savings:

(Cost Savings per Year) x (UPW for Electricity for N = 15 Years)

Added O&M Cost: Assumes 2 MH per year at \$33.50/Hr per controller

LCC Added O&M Costs: Added O&M Cost per Year x Non-Energy UPW for N = 15 Years

Construction Costs: Based on "Means Construction Cost Estimating Guide 1993"

Investment: Construction Cost plus 5.5% SIOH and 6% Design allowance less PG&E Rebate of \$25 per Timer Device. Note, controller and point wiring costs are estimated separately. One controller (with rebate) is expensed per building and one point per controlled drive is expensed).

ECO B-1 (Duty Cycling) Cost Savings

SIR			2.83				1.43				1.06				1.43				1.43				1.43				1.43			1.29	1.55	
Simple	Payback		4.15				8.22				11.19				8.22				8.22				8.22				8.22			9.17	7.61	
Invest	\$		\$4,080				\$4,080				\$4,080				\$4,080				\$4,080				\$4,080				\$4,080			\$3,349	\$31,906	Ā
J&M Saved	\$ CC		(\$745)				(\$745)				(\$745)				(\$745)				(\$745)				(\$745)				(\$745)			(\$745)	(\$2,960)	g the day, ar
O&M Saved O&M Saved	\$/√r		(\$67)				(\$67)				(\$67)				(\$67)				(\$67)				(\$67)				(\$67)			(\$67)	(\$236)	electric resistance space heaters. Assume that 60% are left on during the day, and
Demand	\$LCC		\$12,283	\$4,540	\$1,859	\$190	\$6,589	\$3,717	\$1,142	\$190	\$5,050	\$4,540	\$1,859	\$190	\$6,589	\$4,540	\$1,859	\$190	\$6,589	\$4,540	\$1,859	\$190	\$6,589	\$4,540	\$1,859	\$190	\$6,589	\$3,632	\$1,428	\$5,059	\$55,334	that 60% are
Demand	\$/Yr		\$1,050	\$388	\$159	\$16	\$563	\$318	\$98	\$16	\$432	\$388	\$159	\$16	\$563	\$388	\$159	\$16	\$563	\$388	\$159	\$16	\$563	\$388	\$159	\$16	\$563	\$310	\$122	\$432	\$4,729	s. Assume
Demand	kW Saved		19.6	3.6	1.5	0.1	5.2	2.9	6.0	0.1	4.0	3.6	1.5	0.1	5.2	3.6	tč.	0.1	5.2	3.6	75.	0.1	5.2	3.6	1.5	0.1	5.2	2.86	1.12	3.98	43.55	ace heaters
New	κM		48.3	17.9	7.3	0.7		14.6	4.5	0.7		17.9	7.3	0.7		17.9	7.3	0.7	25.9	17.9	7.3	0.7	25.9	17.9	7.3	0.7	25.9	14.3	5.6	19.91		ance sp
Total	κW		58.0	21.4	8.8	6.0	31.1	17.6	5.4	6.0	23.8	21.4	8.8	6.0	31.1	21.4	8.8	6.0	31.1	21.4	8.8	6.0	31.1	21.4	8.8	6.0	31.1	17.1	6.7	23.9		c resista
ΚW			58.0	21.4	8.8	6.0		8.8	2.7	6.0		21.4	8.8	6.0		21.4	8.8	6.0	31.1	21.4	8.8	6.0	31.1	21.4	8.8	6.0	31.1	17.1	6.74	23.89		W electri
Mtr	Eff		100%	%28	82%	83%		85%	83%	83%		%28	85%	83%		%28	85%	83%		%28	85%	83%		82%	85%	83%		%28	83%			d of 3 k
윺			•	52	10	-		10	က	-		25	10	-		25	10	-		52	10	-		52	10	_		20	7.5			ted load
No.	Ea.	LS	-	-	-	-		2	N	-		-	-	-		-	-	-		-	-	-		-	_	-		-	-			onnec
Item to be	Controlled	Summary of Building Analysis Factors	Elec Res Heaters (1)		Return Fan Motor	Hot Water Pump	Total	Supply Fan Motor	Return Fan Motor	Hot Water Pump	Total	Supply Fan Motor	Return Fan Motor	Hot Water Pump	Total	Supply Fan Motor	Return Fan Motor	Hot Water Pump	Total	Supply Fan Motor	Return Fan Motor	Hot Water Pump	Total	Supply Fan Motor	Return Fan Motor	Hot Water Pump	Total	Fan Coil Unit SA Fan	Fan Coil Unit RA Fan	Total		1. Hacienda has 90 kW connected load of 3 kW
Building		Summary	101	205				206				207				208				229				230				238			Total	NOTES:

assume a 90% room occupancy rate. (The Hacienda is usually filled year-round.) Thus, load is 90 x .60 x .90 = 58 kW. Hacienda electric resistance heaters assumed controlled by 3 panel , each as "one" contact control point.

CONSTRUCTION COST EST	TIMAT	E		Date Prepared June 1993	}	Sheet Of	
Project				Project No.	Basis for	Estimate	
EEAP Limited Energy Study							
Location					Code A	(no design compe	sted)
Fort Hunter-Liggett, California							
Engineer-Architect							
Keller & Gannon Drawing No.		Estimate	or		Checked	By	
			RJB			BIH	
		antity		Labor		Material	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
Programmable Controller	1	EA	\$350	\$350	\$750	\$750	\$1,100
General Conditions @ 8%							\$88
Subtotal							\$1,188
Contractor OH & Profit @ 30%							\$356
Subtotal							\$1,544
Bond @ 1%							\$15
Subtotal							\$1,560
Estimating Contingency @ 10%							\$156
Total Probable Construction Cost							\$1,716
Digital Output Control w/Wiring	1	EA	\$100	\$100	\$320	\$320	\$420
General Conditions @ 8%							\$34
Subtotal							\$454
Contractor OH & Profit @ 30%							\$136
Subtotal							\$590
Bond @ 1%							\$6
Subtotal	1						\$596
Estimating Contingency @ 10%	1		•				\$60
Total Probable Construction Cost							\$655
The second secon							
Annual Publisher	-						
	ļ						
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AP-VALLED	 						
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		:					

ECO B4

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location:		ggett, California nergy Improveme	Region No. 4	Project No. Fiscal Year FY95					
Project Title:		-4 Replace Heat			ulat		13001	11641 1133	
Analysis Date:		Treplace Fleat	y	Economic Life:			Prepa	rer: KELLER 8	GANNON
Allalysis Date.	Warch 1990			20011011110					
1. Investment C	Costs								
A. Construction	Costs			\$2,358					
B. SIOH				\$130					
C. Design Cost				\$142					
D. Total Cost (1	IA+1B+1C)			\$2,630					
E. Salvage Valu	ue of Existing Ed	quipment				\$0			
F. Public Utility	Company Reba	ate		÷		\$0			
G. Total Investr	nent (1D-1E-1F))						\$2,630	
O Emorary Sovie	and (+)/Cost(-):								
Date of NISTIR	ngs (+)/Cost(-): 85-3273-X Usec	for Discount Fa	ctor	s: October 1992	5				
Date of Morni	05 0210 X 0000	, , , , , , , , , , , , , , , , , , , ,							
Energy	Cost	Saving		Annual \$		Discount		Discounted	
Source	\$/MTBU/(1)	MBTU/YR(2)		Savings(3)		Factor(4)		Savings(5)	
A. Elec.	\$21.84	0.1		\$1.15		11.70		\$13	
B. Dist	\$4.98	60.6		\$301.68		13.78		\$4,157	
C. Propane	\$7.87	32.2		\$253.04		14.16		\$3,583	
D. Demand	\$108.60	0.0	kW	\$0.00		11.70		\$0	
E. Other				AFFE 07	=			A= == 1	
F. Total				\$555.87				\$7,754	
3. Non Energy	Savings (+) or	Cost (-):			_				
A. Annual Recu				(\$38)	-				
(1) Discount Fa						11.12		(*	
(2) Discounted	Savings/Cost (3	3A x 3A1)						(\$420)	
B. Non Recurrie	ng Savings (+)	or Cost (-)			•				
Item	Savings(+)	Year of		Discount		Discounted Sa	-		
	Cost(-)(1)	Occur. (2)		Factor(3)		ings(+)Cost(-)	(4)		
2									
a. b.									
C.									
d. Total					•				
d. Total									
C Total Non En	ergy Discounte	d Savings (3A2+	3Bc	14)		(\$420)			
4 Simple Paul	ack 1G//2F3+3	A+(3Bd1/Econor	mic	Life)):		5.1		Years	
	counted Saving					\$7,333		. 5015	
	vestment Ratio					2.79			
7. Adjusted Inte						11.36%			

ECO B4: REPLACE HEATING SYSTEM PIPE INSULATION

efficiency; boiler efficiency for heating systems and the EER (Watts/BTUH) for cooling systems.

Energy Cost Savings

Annual and life cycle energy cost savings are determined as follows:

Annual Energy Cost Savings:

Electricity

kWH/Yr Saved x 0.003413 MBTU/kWH x \$21.84/MBTU = \$/Yr Saved

Propane

MBTU/Yr Saved x \$ 7.87/MBTU = \$/Yr Saved

Fuel Oil

MBTU/Yr Saved x \$ 4.98/MBTU = \$/Yr Saved

Life Cycle Energy Cost Savings for economic life of 15 years:

Electricity

\$/Yr Saved x (15 year UPW: 11.70) = LCC \$ Saved

Propane

\$/Yr Saved x (15 year UPW: 14.16) = LCC \$ Saved

Fuel Oil

\$/Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders:

General Conditions:

8.0%

Estimating Contingency:

10.0%

Contractor's Overhead and Profit:

30.0%

Bond:

1.0% -

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH):

5.5%

Allowance for Design Services:

6.0%

Operation and Maintenance Cost Savings

Maintenance costs are expensed at 2.5% of the bare costs of installation per year. Note that as "Savings", entries are negative, or in parentheses.

Life cycle maintenance cost savings are determined by multiplying the annual maintenance cost savings by the non-energy UPW factor of 11.12 (15 year economic life).

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO B4: REPLACE HEATING SYSTEM PIPE INSULATION

Steam, Hot Water and Chilled Water piping needing replacement insulation is listed by building on the attached tabular summary.

Thermal losses result from uninsulated steam, hot or chilled water piping. Energy savings are achieved when such pipes are insulated.

Energy savings are determined for each pipe size and service type by using nomographs developed by the U.S. Department of Energy (DOE) from their publication: "Energy Conservation in Existing Buildings", February 1980.

Use of the nomographs results in a heat loss (gain) rate of: BTUH per LF for "Bare" pipe and for various thicknesses of insulation on piping. For the purposes of these calculations, it is assumed that 1-inch of insulation is applied.

The attached tabular calculations are performed as follows:

Pipe Heat Loss (Gain) Calculations

Size In-Dia.:

Nominal pipe size, diameter in inches

Length LF:

Pipe length needing insulation, linear feet

Type HW/CHW:

Type of service STM (Steam), HW (Hot Water) and CHW (Chilled Water)

Heat Loss Rate BTU/Hr-LF (from Nomographs)

Bare Pipe:

Rate of heat loss or gain in BTUH/LF for bare pipe determined from the

DOE nomograph

Insulated Pipe:

Rate of heat loss or gain in BTUH/LF for insulated pipe (1-inch

thickness) determined from the DOE nomograph

Heating Degree Hr/Yr:

Heating Degree Hours determined for the building based on meteorologic

data, the building usage schedule and inside thermostatic set points.

Boiler Efficiency:

Heating system boiler efficiency determined based on measurements of

combustion efficiency and a field assessment of existing conditions.

For cooling systems, an EER of 10.0 is assumed.

Energy Savings Calculations

Thermal Loss/Gain:

The thermal loss/gain "Load" is determined by multiplying the difference

between BTUH/LF for bare and insulated pipe by the linear feet of piping

to be insulated.

Annual Loss/Gain:

The annual load loss/gain is determined by multiplying the rate of loss (BTUH) by full load system hours per year. Full load system hours per year is determined by dividing the heating/cooling degree hours per year

by the design winter/summer temperature difference.

Annual Energy Savings:

Annual energy savings is the annual load loss/gain divided by the system

ECO1 B-4 REPLACE PIPE INSULATION

_																						
	Annual	\$ Saved	\$93	\$19				\$112	\$43	\$43	\$21			\$45	\$43	\$43	\$19			\$44	\$36	\$556
Savings	liO	\$/YR	NA	\$19	•	•	1	\$112	\$43	\$43	NA	•	•	NA	\$43	\$43	NA		-	NA	NA	\$305
Annual Energy Cost Savings	Propane	\$/YR	\$93	AN	•	•	•	NA	NA	NA	\$21	•		\$45	NA	AN	\$19	•	•	\$43	\$36	\$253
Annual En	Elec	\$/YR	٧	NA	1	•	1	NA	AN	AN	NA	-	•	NA	NA	NA	NA	-	•	\$1	NA	\$1.14
,	ΙΘ	MBTU/YR	NA	3.8	8.0	10.1	4.4	22.5	8.6	8.6	NA	NA	NA	NA	8.6	8.6	NA	NA	NA	NA	NA	9.09
Savings	Propane	MBTU/YR	11.8	NA	NA	NA	NA	NA	AN	AN	2.7	3.5	1.9	5.4	NA	NA	2.4	5.4	AN	5.4	4.5	32.2
	Elec	KWH/Y N	NA	NA	NA	NA	AN	AN	AN	AN	NA	AN	NA	NA	NA	NA	NA	NA	15.4	15.4	NA	15.4
Boiler	Eff.	%	68.5%	73.7%	%8.02	%8.02	%8.02	,	71.4%	71.4%	61.2%	%0'.29	%0'.29	-	71.4%	71.4%	68.9%	%9.99	EER=10	٠	29.8%	•
Heating	Degree	Hr / Yr	59,325	82,596	115,562	115,562	115,562	•	85,120	85,120	71,537	85,120	85,120	•	85,120	85,120	60,531	60,531	15,420	٠	60,531	-
4	p, su	Pipe	25	20	75	09	25	•	35	35	20	25	15	•	35	35	25	20	2	•	75	-
BTU/Hr-LF	Bare	pipe	150	125	300	250	150	•	200	200	125	150	85	•	200	200	150	325	35	1	280	٠
	Type	нм/сн	MH	MH	MH	MH	MH	-	MH	MH	MH	MH	MH	- '	HW	MH	HW	MLS	WHO	•	STM	•
oss Calcs	Length	占	20	15	10	15	10	•	20	20	10	10	10	- '	20	20	10	10	10	1	10	-
Pipe Heat Loss Calcs	Size	In Dia	1.5	1.25	4	3	1.5	•	2.5	2.5	1.25	1.5	0.75	•	2.5	2.5	1.5	2.5	2	•	2	-
Bldg			80	190	206	206	206	206 TOTAL	207	208	209	219	219	219 TOTAL	229	230	238	241	241	241 TOTAL	291	TOTALS

ECO1 B-4 REPLACE PIPE INSULATION

	SIR		3.19	2.07		,		3.15	2.25	2.25	3.64		,	3.67	2.25	2.25	3.24	,		2.38	3.97	
nalysis	Simple	Payback	4.50	6.79			•	4.44	6.23	6.23	3.94	,		3.90	6.23	6.23	4.43		,	6.03	3.61	
Economic Analysis	Total LCC	Saved \$	\$1,249	\$244	•	٠	•	\$1,471	\$548	\$548	\$285	-	•	\$575	\$548	\$548	\$254	•	•	\$580	\$483	
	ည	Total \$	(\$63)	(\$19)	٠	•	•	(\$75)	(833)	(\$33)	(\$13)	1	1	(\$25)	(\$33)	(68\$)	(\$13)	•	•	(68\$)	(\$19)	
O&M Savings	Annual	\$/Yr	(9\$)	(\$5)	•	•	•	(2\$)	(\$4)	(\$4)	(\$1)		1	(2\$)	(\$4)	(\$4)	(\$1)		1	(\$\$)	(\$5)	
stimate	Investment	Total \$	\$391	\$118	•	•	•	\$468	\$243	\$243	\$78	•	,	\$157	\$243	\$243	\$78	•	•	\$243	\$122	
on Cost Es	Constr	Cost \$	\$351	\$106	•	•	•	\$420	\$218	\$218	\$70	•		\$140	\$218	\$218	\$20	•	1	\$218	\$109	
Construction Cost Estimate	Bare	Cost \$	\$225	\$68	•	•	•	\$269	\$140	\$140	\$45	٠	,	06\$	\$140	\$140	\$45	•	•	\$140	\$20	
J	Total	CC \$	\$1,311	\$263	ΑΝ	Ϋ́	A A	\$1,546	\$587	\$587	\$297	AA	Ϋ́	\$600	\$587	\$587	\$266	A A	A A	\$619	\$503	
Savings	iö	CC \$	AN	\$263	AN	Ϋ́	Ϋ́	\$1,546	\$587	\$587	ΑN	AN	ΑN	AN	\$587	\$587	NA	A A	ΑΝ	AN	NA	
LCC Energy Cost Savings	Propane	CCC \$	\$1,311	Ϋ́	A	¥	Ϋ́	A A	Α̈́	¥	\$297	AN	A A	\$600	A A	NA	\$266	Ϋ́	A A	909\$	\$503	
LCC Ene	Elec	FCC \$	Ä	Ϋ́	Ϋ́	Ϋ́	Ϋ́	Ä	Ž	Ϋ́	Ϋ́	Ä	Ϋ́	Ϋ́	A A	AN	NA	A A	¥	\$13	A A	
Bldg			80	190	206	206	206	206 TOTAL	207	208	209	219	219	219 TOTAL	229	230	238	241	241	241 TOTAL	291	

CONSTRUCTION COST ES	June 1993	3	Sheet of				
Project EEAP Limited Energy Study	Project No.	Basis for Estimate					
Location				1	Code A	(no design compe	ted)
Fort Hunter-Liggett, California Engineer-Architect					-		
Keller & Gannon							
Drawing No.		Estimat	or		Checked	Ву	
ECO B4: Replace Pipe Insulation			RJB			BIH	
Line Item	No. Units	Unit Meas.	Per Unit	Labor	Per Unit	Material Total	Total Cost
Building 80					-		
1-1/2" Pipe Insulation	50	LF	\$2.50	\$125	\$2.00	\$100	\$225
Subtotal Bidg 80						1	\$225
Building 190		 					
1-1/4" Pipe Insulation	15	LF	\$2.50	\$38	\$2.00	\$30	\$68
Subtotal Bldg 190							\$68
Building 206							
1-1/2" Pipe Insulation	10	LF	\$2.50	\$25	\$2.00	\$20	\$45
3" Pipe Insulation	15	LF	\$3.50	\$53	\$5.00	\$75	\$128
4" Pipe Insulation	10	LF	\$3.60	\$36	\$6.00	\$60	\$96
Subtotal Bldg 190							\$269
Building 207							
2-1/2" Pipe Insulation	20	LF	\$3.00	\$60	\$4.00	\$80	\$140
Subtotal Bldg 207							\$140
Building 208							
2-1/2" Pipe Insulation	20	LF	\$3.00	\$60	\$4.00	\$80	\$140
Subtotal Bldg 208							\$140
Building 209							
1-1/4" Pipe Insulation	10	LF	\$2.50	\$25	\$2.00	\$20	\$45
Subtotal Bldg 209					155	720	\$45
Building 219	-		-				
3/4" Pipe Insulation	10	LF	\$2.50	\$25	\$2.00	\$20	\$45
1-1/2" Pipe Insulation		LF	\$2.50	\$25	\$2.00	\$20	\$45
Subtotal Bldg 219				7-5	1	720	\$90
Building 229							
2-1/2" Pipe Insulation	20	LF	\$3.00	\$60	\$4.00	\$80	\$140
Subtotal Bldg 229	 		1	755	1	+55	\$140

CONSTRUCTION COST ES	June 1993	3	Sheet of				
Project EEAP Limited Energy Study		Project No.	Basis for	Estimate			
Location Limited Energy Study	1	Code A	(no design comp	eted)			
Fort Hunter-Liggett, California							
Engineer-Architect							
Keller & Gannon Drawing No.		Estimat	or		Checked	Bv	
ECO B4: Replace Pipe Insulation			RJB			BIH	
		antity		Labor		Material	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
Building 230							
2-1/2" Pipe Insulation	20	LF	\$3.00	\$60	\$4.00	\$80	\$140
Subtotal Bldg 230							\$140
Building 238							
1-1/2" Pipe Insulation	10	LF	\$2.50	\$25	\$2.00	\$20	\$45
Subtotal Bldg 238							\$45
Building 241							
2-1/2" Pipe Insulation	10	LF	\$3.00	\$30	\$4.00	\$40	\$70
2" Pipe Insulation	10	LF	\$3.00	\$30	\$4.00	\$40	\$70
Subtotal Bldg 241							\$140
Building 291			-				
2" Pipe Insulation	10	LF	\$3.00	\$30	\$4.00	\$40	\$70
Subtotal Bldg 291							\$70
							THE STATE OF STREET
			-				

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

ECO B6 & 7

Location: Project Title:	Fort Hunter Ligge ECIP Facility Energ		Region No. 4		Project No. Fiscal Year FY95
Discrete Port	ion Name: ECO B6	& B7 Install Time (Clocks & Programmable T	Thermostats	
Analysis Date	e: June 1993		Economic Life: 15	YEARS	Preparer: KELLER & GANNON
1. Investment			400.700		
A. Constructi	on Costs		\$66,786		
B. SIOH			\$3,673		
C. Design Co			\$4,007		
	(1A+1B+1C)		\$74,467	c o	
	alue of Existing Eq			\$0	_
	ty Company Rebat	e		(\$13,510)	
G. Total Inve	stment (1D-1E-1F)				\$60,957
2. Energy Sa	vings (+)/Cost(-):				
		for Discount Factors	s: October 1992		
	0	Cavina	Annual &	Discount	Dissounted
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$21.84	686.9	\$15,001	11.70	\$175,515
B. Dist	\$4.98	2,460.0	\$12,251	13.78	\$168,816
C. Propane	\$7.87	3,223.3	\$25,367	14.16	\$359,202
D. Demand	\$108.60		kW \$0	11.70	\$0
E. Other					
F. Total			\$52,619		\$703,533
3. Non Energ	y Savings (+) or C	ost (-):			
A. Annual Re	curring (+/-)		(\$1,689)		
	Factor (Table A)		(41,1551)	11.12	
	ed Savings/Cost (3/	A x 3A1)			(\$18,781)
(2) 2.0000		,			(***)
B. Non Recui	rring Savings (+) o	r Cost (-)			
14	Cavings (1)	Van of	Discount	Discounted Sav-	
ltem	Savings(+)	Year of		ings(+)Cost(-)(4)	
	Cost(-)(1)	Occur. (2)	Factor(3)	11gs(+)Cost(-)(4)	
a.					
b.			•		•
C.					
d. Total					
C Total Non I	Energy Discounted	Savings (3A2+3Bd	4)	(\$18,781)	
	5,	J (31 = 1 3 = 4		· -,·,	
	•	+(3Bd1/Economic	_ife)):	1.2	Years
	Discounted Savings			\$684,752	
6. Savings to	Investment Ratio (SIR) 5/1G:		11.23	
7. Adjusted In	nternal Rate of Retu	ırn (AIRR):		22.20%	

ECO B6 & B7: INSTALL TIME CLOCKS & PROGRAMMABLE THERMOSTATS

Installation of controls for HVAC systems will reduce energy consumption by scheduling heating and cooling service for times when it is needed and control temperatures depending on building use. Time clocks and programmable thermostats are recommended for installation in buildings which are listed in the following tabular calculations.

Energy savings are achieved by providing use-appropriate temperature control. For example, shops and warehouses are not heated to the same temperatures as are offices and dwellings. Energy savings are also achieved by controlling building HVAC systems to provide heat and cooling only during the days and times of day when it is needed. Setback temperature control is also made possible, i.e., the reduction of space heating temperature setpoints when spaces are not scheduled for use. The simultaneous operation of heating and cooling systems is also prevented by installation of these controls.

Time clocks are specified whenever building occupants do not have direct access to HVAC controls. Programmable thermostats are used for buildings and zones which require occupant control of HVAC functions.

Energy Savings Calculations

Energy savings calculations are a function of the building operating schedule, present controls, the building heating and cooling loads, site weather data, present and authorized space temperatures and operating schedules.

Heating and cooling loads are determined using either the TRANE-TRACE building energy use computer program or manual calculations for both the "Baseline" and proposed control conditions. Energy savings are calculated by applying building HVAC system operating parameters to calculated load savings. Calculations depend, in large part, on heating and cooling degree hours calculated for time and temperature schedules of each building.

Degree hours are calculated based on simulated bin temperature data (refer to EEAP Limited Energy Study for Fort Hunter Liggett, dated 1993). The design temperature difference during each temperature period and time-of-year are used to calculate total annual heating and cooling degree hours. Full load hours are determined and multiplied by the building block load and divided by HVAC device efficiencies to determine energy use with and without proposed controls.

Annual energy cost savings are based on energy savings calculations and energy costs:

Electricity	kWH/Yr Saved x 0.003413 MBTU/kWH x \$21.84/MBTU = \$/Yr Saved
Propane	MBTU/Yr Saved x \$ 7.87/MBTU = \$/Yr Saved
Fuel Oil	MBTU/Yr Saved x \$ 4.98/MBTU = \$/Yr Saved

Life Cycle Energy Cost Savings for economic life of 15 years:

Electricity	\$/Yr Saved x (15 year UPW: 11.70) = LCC \$ Saved
Propane	\$/Yr Saved x (15 year UPW: 14.16) = LCC \$ Saved
Fuel Oil	\$/Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

ECO B6 & B7: INSTALL TIME CLOCKS & PROGRAMMABLE THERMOSTATS

Construction cost is determined by applying the following cumulative adders to bare costs:

General Conditions:8.0%Estimating Contingency:10.0%Contractor's Overhead and Profit:30.0%Bond:1.0%

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH): 5.5%
Allowance for Design Services: 6.0%

PG&E rebates of \$40 per thermostat are subtracted to determine the final investment.

Operation and Maintenance Cost Savings

Additional O&M costs are expensed to provide initial and annual follow-up training and instructions concerning the operation of the proposed control systems. The additional annual O&M cost is \$6.05 per thermostat (or time clock).

Life cycle additional O&M costs are determined by multiplying the annual additional O&M costs by the non-energy UPW factor of 11.12 (15 year economic life).

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO B6/7 TIME CLOCKS AND PROGRAMMABLE THERMOSTATS

Fac		Existing Schedule	elubed	Heating Season		Cooling	Degree Ho	Degree Hours per Year, 7 Days/WI	7 Days/Wk			FULL LOAD HOURS/YEAR	OURS/YEAR
Š	Installation Name	Time	Time	Setpoint	ack	Setpoint	Heating	Heating	Htg Setbk	Total	Total	Heating	Cooling
		HVAC ON HVAC	HVAC OF	Deg F		Deg F	o S	_	7 Day/Wk	Heating	Cooling	FLHr/Yr	FLHr/Yr
P 80	Exchange, Main Retail	006	1700	89	55	72	18,715	40,610	44,615	59,325	18,106	425	604
P 101	Open Din Cone (Haclenda)	000	1600	20	52	72	14,616	42,688	44,615	57,304	15,420	318	514
	Club (Bar)	98	2200	2	22	72	21,855	40,134	44,615	61,989	9,650	475	322
	Haclenda, East Rooms	1700	8	2	22	ž	98,616	7,025	44,615	105,641	Ž	2,144	0
	nacierida, west nooriis								1				
T 121	Bowling Center	800	5200	89	SS	72	42,842	33,140	44,615	67,020	21,833	911	250
P 128	Officers Quarters Military	009	2200	89	55	72	60,015	25,104	44,615	85,119	21,833	1,364	728
S 146	FE Facility	700	1600	55	40	78	10,781	3,537	5,161	11,702	9,003	281	268
T 161	Admin General Purpose	200	1600	89	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 162	Elec Maint. Shop	700	1600	89	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 163	Officers Quarters Military	200	1600	88	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 164	Admin General Purpose	700	1600	89	55	72	33,064	33,833	44,615	60,531	15,420	756	367
T 165	Admin General Purpose	200	1600	89	52	72	33,064	33,833	44,615	60,531	15,420	756	296
166	Officers Quarters Military	200	1600	89	22	72	33,064	33,833	44,615	60,531	15,420	756	298
T 167	Officers Quarters Military	700	1600	89	55	72	33,064	33,833	44,615	60,531	15,420	756	367
P 177	Technical Library	200	1600	89	. 55	72	33,064	33,833	44,615	60,531	15,420	126	298
P 178	Child Development Cntr	009	1800	7.5	55	72	56,886	29,446	44,615	74,412	19,953	1,022	475
S 182	Commissary	006	1700	89	22	72	18,715	40,610	44,615	55,122	18,106	268	431
S 186	Sup Svc Admin Bidg	200	1600	88	52	72	33,064	33,833	44,615	60,531	15,420	156	367
P 205 P 205A	Admin General Purpose Company HQ Building	009	2200	88	55	72	60,015	25,104	44,615	73,547	21,833	1,137	250
P 207 P 207A	Eni Barracks w/o Dining Company HQ Building	009	2200	89	. 22	72	60,015	25,104	44,615	85,119	21,833	1,364	728
P 208		900	2200	89	55	72	60,015	25,104	44,615	85,119	21,833	1,364	728
P 209		009	1600	68	55	72	41,952	29,585	44,615	71,537	15,420	953	514
P 212	Gymnasium	1000	2100	9	40	72	18,590	5,161	5,161	23,751	21,833	453	728
P 229 P 229A		009	2200	88	55	72	60,015	25,104	44,615	85,119	21,833	1,364	728
P 230 P 230A		009	2200	89	55	72	60,015	25,104	44,615	85,119	21,833	1,364	728
S 283	FE Maintenance Shop	200	1700	22	40	72	10,781	4,287	5,161	12,238	15,420	288	367
S 290	Electron Equip Facility	200	1600	89	55	72	33,064	33,833	44,615	60,531	15,420	95/	296
S 291	Cont Humid Warehouse	200	1600	89	55	72	33,064	33,833	44,615	60,531	15,420	992	367
P 295	Eni Barracks w/o Dining	009	2200	89	55	72	60,015	25,104	44,615	85,119	21,833	1,364	728
301	ADP Building Office	200	1600	89	22	72	33,064	33,833	44,615	60,531	15,420	156	298
	Computer Room	0	2400	89	89	74	115,562	0	0	115,562	17,007	2,626	209

1.20 Payback 0.18 4.34 1.31 2.71 1.57 1.57 1.57 1.57 1.57 1.57 0.00 0.00 0.74 1.14 0.43 0.32 1.67 0.12 6.42 1.1 8 0.25 Simple Savings \$18,659 \$22,296 \$3,113 \$3,113 \$3,113 \$684,752 \$3,113 \$3,113 \$4,871 \$7,302 \$5,405 \$32,910 \$32,910 \$36,845 \$32,910 \$16,261 \$185,695 \$2,545 \$41,864 \$43,451 LCC,N=15 \$850 \$287 7 \$287 7 \$287 8 \$2 \$60,957 \$387 \$23,193 \$387 Total Invest \$257 \$8,221 \$8,891 \$2,706 \$2,706 \$2,706 \$183 \$773 \$387 88 89 88 833 \$13,510 \$5,400 \$2,070 Rebate \$40 \$1,280 PG&E 8 \$630 \$630 \$630 \$ \$180 \$74,467 \$28,593 \$477 Total Cost \$297 \$9,501 \$10,961 \$3,336 \$3,336 \$477 \$3,336 \$3,336 24 \$238 \$953 \$9,830 \$4427 \$427 \$427 \$427 \$427 \$214 \$214 \$214 \$214 \$214 \$214 \$218 \$427 \$25,644 \$427 \$66,786 \$427 \$427 \$2,992 Coast Cost \$267 \$2,992 \$2,992 \$427 \$214 \$855 \$208 \$274 \$274 \$274 \$274 \$274 \$217 \$137 \$218 \$218 \$218 \$218 \$218 \$274 \$16,440 \$274 \$42,816 S171 \$171 \$5,463 \$6,302 \$1,918 \$1,918 \$274 \$274 \$1,918 \$1,918 \$548 \$274 \$137 (\$677) (\$ (\$18,781) (\$77) (\$944) (\$944) (\$8,095) (\$7) \$ Total (\$7) (\$2,159) (\$3,103) (\$944) (\$270) (\$1) (\$67) (\$1,689) \$/Yr (\$134) (\$85) (\$1) (\$85) (\$728) (\$728) <u>£</u> (\$85) (\$82) 8 (\$24) Non-Egy \$52,619 Total \$/Year \$1,442 \$2,090 \$7,057 \$2,458 \$2,458 \$908 \$2,619 \$2,458 \$2,458 \$185 \$1,215 \$14,645 \$3,188 960'8\$ 8 8888888888888888 \$2,450 \$12,251 Fuel Oil 888 8 8 \$2,450 \$2,450 \$2,450 8 8 \$/Year ECO B6/B7 Energy Cost Savings \$25,367 \$54 \$2,526 \$728 \$5,375 \$832 \$9,125 \$2,502 \$/Year Propane 84 8 8 8 \$2,403 \$181 \$76 \$150 \$150 \$150 \$150 \$150 \$150 \$150 \$150 \$150 \$263 \$263 \$38 \$38 \$15,001 \$/Year \$715 \$2,090 \$1,683 \$853 88 \$383 \$5,520 \$687 8 8 Electric 8 ¥ \$693 2,460 Mil BTU/Yr 0.0 0.0 0.0 Fuel Oil 492.0 492.0 492.0 0.0 0.0 0.0 3,223 92.5 682.9 6.9 321.0 105.7 1,159.5 317.9 Propane 305.4 ECO B6/B7 Energy Savings Mil BTU/Yr 0.0 23.0 9,589 28,041 1,022 2,006 2,006 2,006 2,006 2,006 2,006 2,006 2,006 2,006 3,526 2,588 2,588 3,197 105 201,252 1,238 5,142 74,049 9,212 Electric 186 105 105 105 57 9,292 S 182 S 182 S 186 P 205 P 207 P 207 P 208 P 208 P 209 P 212 P 229 P 230 P 230A S 283 \$ 146 1 162 1 162 1 163 1 165 1 166 1 167 1 167 No. P 128 S 291 P 295 P 301 P 80 8 290 121

8.054 8.054 8.054 8.054 25.203 199.829 27.965 12.163

12.163

27.803 95.318 12.163 13.170

54.151

12.163

4.845 8.054 8.054 8.054

2.122

SIR 72.489 2.712 42.067 8.007 112.407

11.233

ECO B6/7 TIME CLOCKS AND PROGRAMMABLE THERMOSTATS

CONSTRUCTION COST F	OT18467	_		Date Prepared		SHEET (OF
CONSTRUCTION COST E	SIIMAI	E		June 1993	3		
Project		.		Project No.	Basis for	Estimate	
EEAP Limited Energy Study							
Location			-		Code A	(no design compe	eted)
Fort Hunter-Liggett, California Engineer-Architect					-		
Keller & Gannon							
Drawing No.		Estimato	or		Checked	Ву	
ECO-B6/7 (T-Clock / Programmable		RJB			ВІН		
Line Item	No.	antity Unit	Per	bor	Per	Material	Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
Building 80			A m4	454	0400		
Time Clock & Wiring	1	EA	\$51	\$51	\$120	\$120	\$171
Subtotal (Bldg 80)		<u> </u>			L		\$171
Building 101 Dining & Lounge Areas							
Time Clock & Wiring - Din/Lng	2	EA	\$51	\$102	\$120	\$239	\$341
Time Clock & Wiring - Dwellings	30	EA	\$51	\$1,534	\$120	\$3,587	\$5,121
Subtotal (Bldg 101 Dining & Lounge	Areas ar	nd Dwe	lling Unit	s)			\$5,463
Building 121							
24 Hour Auto T-Stat	2	EA	\$32	\$64	\$105	\$210	\$274
Subtotal (Bldg 121)							\$274
Building 128							
24 Hour Auto T-Stat	46	EA	\$32	\$1,472	\$105	\$4,830	\$6,302
Subtotal (Bldg 128)							\$6,302
Building 146							
24 Hour Auto T-Stat	1	EA	\$32	\$32	\$105	\$105	\$137
Time Clock & Wiring	1	EA	\$51	\$51	\$120	\$120	\$171
Subtotal (Bldg 146)							\$308
Buildings 161, 162, 163, 164, 165, 16	6 & 167,	each					
24 Hour Auto T-Stat	2	EA	\$32	\$64	\$105	\$210	\$274
Subtotal (Bldgs 161, 162, 163, 164, 1	65, 166	& 167,	each)				\$274
Building 177							
24 Hour Auto T-Stat	1	EA	\$32	\$32	\$105	\$105	\$137
Subtotal (Bldg 177)							\$137
Building 178							
Reset Existing Timer	1	EA	\$16	\$16	\$5	\$5	\$21
Subtotal (Bldg 178)							\$21
Building 182			_				
24 Hour Auto T-Stat	1	EA	\$32	\$32	\$105	\$105	\$137
Subtotal (Bldg 182)							\$137
Building 186							
24 Hour Auto T-Stat	2	EA	\$32	\$64	\$105	\$210	\$274
Subtotal (Bldg 186)							\$274
							, , , , , , , , , , , , , , , , , , ,
Subtotal, this Sheet, including all bui	ldings					· -	\$15,004

	TIL 4 4 T	_		Date Prepared		SHEET	OF
CONSTRUCTION COST ES	SIIMAI	E		June 1993	3		
Project				Project No.	Basis for	Estimate	
EEAP Limited Energy Study						(no desire	-AA
Location					Code A	(no design comp	eted)
Fort Hunter-Liggett, California Engineer-Architect					4		
Keller & Gannon							
Drawing No.		Estimator	•		Checked	Ву	
ECO-B6/7 (T-Clock / Programmable	Tstat)	RJB			BIH		
	Qui No.	antity Unit	Per La	abor	Per	Material	Total
Line Item	Units	Meas.	Unit	Total	Unit	Total	Cost
Buildings 205, 207, 208, 229 & 230, e	ach						
24 Hour Auto T-Stat		EA	\$32	\$448	\$105	\$1,470	\$1,91
Subtotal (Bldgs 205, 207, 208, 229 &	230, ead	ch)					\$1,918
Building 209		T					•
24 Hour Auto T-Stat	2	EA	\$32	\$64	\$105	\$210	\$274
Subtotal (Bldg 209)							\$27
Building 212							
24 Hour Auto T-Stat	2	EA	\$32	\$64	\$105	\$210	\$27
Subtotal (Bldg 212)							\$27
Building 283							
24 Hour Auto T-Stat	1	EA	\$32	\$32	\$105	\$105	\$13
Subtotal (Bldg 283)	- 	1		-	1	7.00	\$13
Building 290							
24 Hour Auto T-Stat	4	EA	\$32	\$128	\$105	\$420	\$54
Subtotal (Bldg 290)	 			1.25	4.55	V.25	\$54
Building 291							40-1
24 Hour Auto T-Stat	2	EA	\$32	\$64	\$105	\$210	\$27
Subtotal (Bldg 291)	-		402	40.	4.00	QZ.IO	\$27
Building 295					-		ΨΕΙ
24 Hour Auto T-Stat	120	EA	\$32	\$3,840	\$105	\$12,600	\$16,44
Subtotal (Bldg 295)	120	-	Ψ02	Ψ5,040	\$105	\$12,000	\$16,44
Building 301							\$10,44
24 Hour Auto T-Stat		EA	\$32	\$64	\$105	\$210	¢ባፖ
Subtotal (Bldg 301)		LA	φ32	504	\$105	\$210	\$27 \$27
Subtotal (Blug 301)					ļ		921
Cubatal this sheet				L	1		¢07.04
Subtotal, this sheet							\$27,81
Subtotal (ECO B-6/7), all sheets	<u> </u>	т т	-	T	T		\$42,81
General Conditions 8%					1		\$3,42
Subtotal		+ +					\$46,24
Contractor O.H. & P. 30%		1					\$13,87
Subtotal	-	+					\$60,11
Bond 1%	_						\$60
Subtotal							\$60,71
Estimating Contingency 10%							\$6,07
Total Probable Construction Cost							\$66,78

ECO B-8

Fort Hunter Liggett, California Region No. 4 Project No. Location: Project Title: ECIP Facility Energy Improvements Fiscal Year FY95 Discrete Portion Name: ECO B-8 Replace Inefficient Chillers 15 YEARS Preparer: KELLER & GANNON Analysis Date: June 1993 Economic Life: 1. Investment Costs \$400,158 A. Construction Costs \$22,009 B. SIOH \$24,009 C. Design Cost \$446,176 D. Total Cost (1A+1B+1C) \$0 E. Salvage Value of Existing Equipment \$19,688 F. Public Utility Company Rebate G. Total Investment (1D-1E-1F) \$426,488 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273-X Used for Discount Factors: October 1992 Annual \$ Discount Discounted Energy Cost Saving MBTU/YR(2) Savings(3) Factor(4) Savings(5) Source \$/MTBU/(1) 353.7 \$7,724 11.70 \$90,371 A. Elec. \$21.84 \$4.98 0.0 \$0 13.78 \$0 B. Dist \$7.87 0.0 \$0 14.16 \$0 C. Propane 164.1 \$17,821 11.70 \$208,508 D. Demand \$108.60 E. Other \$25,545 \$298,880 F. Total 3. Non Energy Savings (+) or Cost (-): \$0 A. Annual Recurring (+/-) 11.12 (1) Discount Factor (Table A) \$0 (2) Discounted Savings/Cost (3A x 3A1) B. Non Recurring Savings (+) or Cost (-) Discount Discounted Sav-Item Savings(+) Year of Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) \$107,993 3 0.89 \$96,114 a. \$221,264 5 0.82 \$181,437 b. \$30,885 10 0.67 \$20,693 \$298,243 \$360,142 d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) \$298,243 4. Simple Payback 1G/(2F3+3A+(3Bd1/Economic Life)): 8.6 Years 5. Total Net Discounted Savings (2F5+3C): \$597,123 6. Savings to Investment Ratio (SIR) 5/1G: 1.40 6.36% 7. Adjusted Internal Rate of Return (AIRR):

ECO B8: REPLACE INEFFICIENT CHILLERS

Many HVAC refrigeration devices (chillers and air conditioners) at Fort Hunter Liggett are inefficient. Energy savings can be achieved by replacing the original systems installed with newer, high efficiency devices. Most of the existing systems were constructed before new efficiency standards were in place. They are aging and many are at the ends of their economic lives.

Replacing existing units with new, high efficiency units is proposed.

Energy Savings

Electric power consumption of existing units is based on field measurements of equipment operating efficiencies and on computer and manual simulations of building cooling energy use. Refer to EEAP Limited Energy Study for Fort Hunter Liggett, dated 1993 for baseline energy use calculations. Energy savings are determined by considering coefficients of performance (COP) and energy efficiency ratios (EER) of proposed new equipment against those of existing equipment. The electrical power needed to satisfy the same cooling loads with new vs. existing devices is compared. The differences constitute electric power savings.

The COP's and EER's of proposed replacement units are provided by equipment manufacturers for the design conditions at Fort Hunter Liggett.

Both electric power use and demand are lowered by the proposed equipment replacements. Refer to the attached tabular calculations.

Energy Cost Savings

Annual and life cycle energy cost savings are determined as follows:

Annual Energy Cost Savings:

Electric Use kWH/Yr Saved x 0.003413 MBTU/kWH x \$21.84/MBTU = \$/Yr Saved Electric Demand kW Saved x \$108.60/Year-kW = \$/Yr Saved from demand charges

Life Cycle Energy Cost Savings for economic life of 15 years:

Electric Use \$/Yr Saved x (15 year UPW: 11.70) = LCC \$ Saved Electric Demand \$/Yr Saved x (15 year UPW: 11.70) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on equipment manufacturer quotes and on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders:

General Conditions: 8.0%
Estimating Contingency: 10.0%
Contractor's Overhead and Profit: 30.0%
Bond: 1.0%

ECO B8: REPLACE INEFFICIENT CHILLERS

Total Cost is determined by adding the following line items to the Construction Cost:

Supervision, Inspection and (Government) Overhead (SIOH): 5.5%
Allowance for Design Services: 6.0%

It is assumed that existing units to be removed have salvage values equal to their disposal costs.

PG&E, the utility company supplying electric power offers a rebate for replacement of inefficient cooling equipment with high efficiency equipment. The rebate depends on device efficiency improvement; rebates for each proposed replacement are shown on the attached tabular calculations.

Investment is determined by subtracting the utility company rebate from the Total Cost.

Operation and Maintenance Cost Savings

Maintenance costs are assumed the same as for existing equipment.

Avoided Cost of Equipment Replacement

The economic life of HVAC equipment is set at 15 years for ECIP project evaluations. All the refrigeration devices proposed for replacement will need to be replaced before the end of the project life cycle analysis period. Thus, equipment replacement costs are expensed as a single year cash flow (savings) discounted for the year of occurence. Remaining equipment lifetimes used in economic analysis calculations are based on discussions with maintenance personnel at Fort Hunter Liggett. Refer to the attached tabular calculations.

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and avoided cost savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO B8 - Replace Inefficient Chillers

Fac No.	Installation Name	Unit	Existing	Existing	New	New		Demand
		Nominal	Cing Usage	Unit EER	Unit EER	Cing Usage	Savings	Savings
		Tonnage	(KWH/YR)			(KWH/YR)	(KWH/YR)	(KW)
P 101	Open Din Cons (Hacienda)	20	3,549	7.5	9.7	2,744	805	7.3
P 128	Officers Quarters Military	25	37,747	7.5	9.7	29,186	8,561	9.1
P 205	Admin General Purpose	80	75,112	8.5	10.6	60,231	14,881	22.4
P 207	Enl Barracks w/o Dining	80	75,112	8.5	10.6	60,231	14,881	22.4
P 208	Enl Barracks w/o Dining	80	79,250	8.5	10.6	63,550	15,700	22.4
P 229	Enl Barracks w/o Dining	80	79,250	8.5	10.6	63,550	15,700	22.4
P 230	Enl Barracks w/o Dining	80	79,250	8.5	10.6	63,550	15,700	22.4
S 290	Electron Equip Facility	25	4,843	7.5	9.3	3,906	937	7.7
P 295	Enl Barracks w/o Dining	54	93,825	8.5	9.8	81,379	12,446	10.1
P 301	ADP Building	60	18,832	8.5	10.8	14,821	4,011	18.0
	TOTALS		546,770			443,147	103,623	164

ECO B8 - Replace Inefficient Chillers

Fac						Single Yea	r Savings	(1)	
No.	Annual	Life Cycle			Total		Year	LCC	Savings
	Cost	Cost	Capitol	PG&E	Invest	Savings	Saving	Savings	Investment
	Savings (\$)	Savings (\$)	Costs (\$)	Rebate	\$	\$	Occurs	\$	Ratio (SIR)
P 101	\$848	\$9,924	\$22,852	\$1,760	\$23,720	\$20,567	3	\$18,304	1.19
P 128	\$1,623	\$18,994	\$24,544	\$2,200	\$25,167	\$22,090	5	\$18,113	1.47
P 205	\$3,539	\$41,408	\$44,261	\$1,120	\$48,231	\$39,835	5	\$32,665	1.54
P 207	\$3,539	\$41,408	\$44,261	\$1,120	\$48,231	\$39,835	5	\$32,665	1.54
P 208	\$3,600	\$42,123	\$44,261	\$1,120	\$48,231	\$39,835	5	\$32,665	1.55
P 229	\$3,600	\$42,123	\$44,261	\$1,120	\$48,231	\$39,835	5	\$32,665	1.55
P 230	\$3,600	\$42,123	\$44,261	\$1,120	\$48,231	\$39,835	5	\$32,665	1.55
S 290	\$911	\$10,655	\$24,451	\$1,800	\$25,463	\$22,006	3	\$19,585	1.19
P 295	\$2,026	\$23,704	\$72,689	\$2,808	\$78,240	\$65,420	3	\$58,224	1.05
P 301	\$2,258	\$26,419	\$34,317	\$5,520	\$32,743	\$30,885	10	\$20,693	1.44
	\$25,545	\$298,880	\$400,158	\$19,688	\$426,488	\$360,142	-	\$298,243	1.40

NOTE:

Single year (Non-recurring, non-energy) cost savings represent the avoided cost of replacing units at the ends of their useful lifetimes. Remaining lifetimes, shown by "year of savings" are DEH maintenance worker opinions based on years of experience maintaining the equipment.

		- +		Date Prepared		Sheet of	
CONSTRUCTION COST	ESTI	MATE		June 199	93		
Project				Project No.	Basis for Estim	ate	
EEAP Limited Energy Study	<u> </u>						
Location					Code A (no d	lesign competed)
Fort Hunter-Liggett, Californ Engineer-Architect	ııa	:-			1		
Keller & Gannon							
Drawing No.		Estimate	or		Checked By		
ECO B-8 REPLACE COOLING EC			JCC			BIH	
Line Mann	Qu No.	antity I Unit	La Per	abor	Mater Per	al	7-4-1
Line Item	Units	Meas.	Unit	Total	Unit	Total	Total Cost
BUILDING 101					•		
Demolish existing unit	1	EA	\$750	\$750	-	\$0	\$750
Install 20 ton Air Cooled Unit	1	EA	\$2,400	\$2,400	\$11,500	\$11,500	\$13,900
Subtotal							\$14,650
General Conditions @ 8%							\$1,172
Subtotal							\$15,822
Contractor OH & Profit @ 30%							\$4,747
Subtotal							\$20,569
Bond @ 1%							\$206
Subtotal							\$20,774
Estimating Contingency @ 10%							\$2,077
TOTAL PROBABLE CONSTRUCT	ION C	OST			•		\$22,852
BUILDING 128	1			1	I	1	
Demolish existing unit	1	EA	\$810	\$810	-	\$0	\$810
Install 25 ton Air Cooled Unit	1	EA	\$2,625	\$2,625	\$12,300	\$12,300	\$14,925
Subtotal			· · · · · · · · · · · · · · · · · · ·	,	, , , , , , , , , , , , , , , , , , , ,	, , , , , , ,	\$15,735
General Conditions @ 8%							\$1,259
Subtotal	1						\$16,994
Contractor OH & Profit @ 30%	1						\$5,098
Subtotal							\$22,092
Bond @ 1%							\$221
Subtotal	1						\$22,313
Estimating Contingency @ 10%							\$2,231
TOTAL PROBABLE CONSTRUCT	ION CO	ÖST		<u> </u>	1		\$24,544
TOTAL I HODADEL GONOTHOOT	.5.4 50						Ψ 24 ,3

				Date Prepared		Sheet of	
CONSTRUCTION COST	ESTI	MATE		June 199	93		
Project				Project No.	Basis for Estim	ate	
EEAP Limited Energy Study	•						
Location					Code A (no d	lesign competed)
Fort Hunter-Liggett, Californ	ia						
Keller & Gannon							
Drawing No.		Estimate	or		Checked By		
ECO B-8 REPLACE COOLING EC			JCC			BIH	
Line Item	No.	antity Unit	Per La	abor	Mater	ai I	Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
BUILDING 205, 207, 208, 229 & 2	30 (EA			¥	,		
Demolish existing unit	1	EA	\$750	\$750	-	\$0	\$750
Install 80 ton Air Cooled Unit	1	EA	\$2,625	\$2,625	\$25,000	\$25,000	\$27,625
Subtotal							\$28,375
General Conditions @ 8%							\$2,270
Subtotal							\$30,645
Contractor OH & Profit @ 30%							\$9,194
Subtotal							\$39,839
Bond @ 1%							\$398
Subtotal							\$40,237
Estimating Contingency @ 10%							\$4,024
TOTAL PROBABLE CONSTRUCT	ION C	OST					\$44,261
BUILDING 290							
Demolish existing unit	1	EA	\$750	\$750	-	\$0	\$750
Install 80 ton Air Cooled Unit	1	EA	\$2,625	\$2,625	\$12,300	\$12,300	\$14,925
Subtotal							\$15,675
General Conditions @ 8%							\$1,254
Subtotal							\$16,929
Contractor OH & Profit @ 30%							\$5,079
Subtotal							\$22,008
Bond @ 1%							\$220
Subtotal							\$22,228
Estimating Contingency @ 10%							\$2,223
TOTAL PROBABLE CONSTRUCT	ION C	OST					\$24,451

				Date Prepared		Sheet of	
CONSTRUCTION COST	ESTI	MATE		June 199	93		
Project				Project No.	Basis for Estim	ate	
EEAP Limited Energy Study							
Location					Code A (no d	design competed)
Fort Hunter-Liggett, Californ	ia						
Engineer-Architect							
Keller & Gannon Drawing No.		Estimat	or		Checked By		
ECO B-8 REPLACE COOLING EC	UIP.		JCC			BIH	
		antity		abor	Mater	al	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
BUILDING 295							
Demolish existing unit	1	EA	\$1,250	\$1,250	-	\$0	\$1,250
Install 80 ton Air Cooled Unit	1	EA	\$6,450	\$6,450	\$38,900	\$38,900	\$45,350
Subtotal							\$46,600
General Conditions @ 8%							\$3,728
Subtotal							\$50,328
Contractor OH & Profit @ 30%							\$15,098
Subtotal							\$65,426
Bond @ 1%							\$654
Subtotal							\$66,081
Estimating Contingency @ 10%							\$6,608
TOTAL PROBABLE CONSTRUCT	ION C	OST					\$72,689
BUILDING 301							
Demolish existing unit	1	EA	\$1,000	\$1,000	-	\$0	\$1,000
Install 80 ton Air Cooled Unit	1	EA	\$2,100	\$2,100	\$18,900	\$18,900	\$21,000
Subtotal							\$22,000
General Conditions @ 8%							\$1,760
Subtotal							\$23,760
Contractor OH & Profit @ 30%							\$7,128
Subtotal							\$30,888
Bond @ 1%							\$309
Subtotal							\$31,197
Estimating Contingency @ 10%							\$3,120
TOTAL PROBABLE CONSTRUCT	ON CO	OST					\$34,317

ECO B10

Location: Project Title:	Fort Hunter Ligg	gett, California ergy Improvements	Region No. 4		Project No. Fiscal Year FY95
			Flue Dampers on Heati	ng System Boilers	
	e: June 1993			15 YEARS	Preparer: KELLER & GANNON
1. Investmen	t Costs				
A. Constructi	on Costs		\$13,059		
B. SIOH			\$718		
C. Design Co			\$784		
	(1A+1B+1C)	•	\$14,561	¢0	
-	alue of Existing Ed			\$0 \$0	_
	ity Company Reba stment (1D-1E-1F)			ΨΟ	_ \$14,561
G. Total live	stinent (10-12-17)				ψ14,501
2. Energy Sa	vings (+)/Cost(-):				
Date of NIST	IR 85-3273-X Used	for Discount Factor	rs: October 1992		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$21.84	0.0	\$0	11.70	\$0
B. Dist	\$4.98	282.8	\$1,408	13.78	\$19,408
C. Propane	\$7.87	174.3	\$1,372	14.16	\$19,423
D. Demand	\$108.60	0.0	kW \$0	11.70	\$0
E. Other					
F. Total		457.1	\$2,780		\$38,830
3. Non Energ	y Savings (+) or	Cost (-):			
A. Annual Re	curring (+/-)		\$0 ·		
(1) Discount	Factor (Table A)			11.12	
(2) Discounte	ed Savings/Cost (3	3A x 3A1)			\$0
B. Non Recu	rring Savings (+)	or Cost (-)			
ltem	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a.					
b.			<u>.</u>		
C.					
d. Total					
C Total Non	Energy Discounte	d Savings (3A2+3Bo	i4)	\$0	
4. Simple Pa	yback 1G/(2F3+3	A+(3Bd1/Economic	Life)):	5.2	Years
5. Total Net I	Discounted Saving	ıs (2F5+3C):		\$38,830	
	Investment Ratio			2.67	
7. Adjusted la	nternal Rate of Re	turn (AIRR):		11.03%	

ECO B10: INSTALL AUTOMATIC FLUE DAMPERS ON HEATING SYSTEM BOILERS

This measure is developed to evaluate the potential energy savings created by the installation of an automatic damper which closes off the flue whenever the burner has completed a firing cycle.

During normal operations, about 2% to 3% of boiler fuel use is lost through the flue between burner firing cycles.

Energy Savings Calculations

Energy savings are achieved by raising the boiler/heater efficiency by about 1.5%. Fuel savings are determined based on baseline fuel use and existing boiler efficiencies. Baseline energy use and system efficiency determinations are provided in: "EEAP Limited Energy Study for Fort Hunter Liggett", dated 1993. Savings are calculated as follows:

 $Qs = Qo - Qo \times Efficiency / (Efficiency + 1.5\%)$

where:

Qs = Fuel Savings

Qo = Baseline fuel use (after reduction of domestic hot water

temperatures to authorized levels)

Efficiency Baseline system efficiency

Annual energy cost savings are based on fuel savings calculations as explained above:

Propane

MBTU/Yr Saved x \$ 7.87/MBTU = \$/Yr Saved

Fuel Oil

MBTU/Yr Saved x \$ 4.98/MBTU = \$/Yr Saved

Life Cycle Energy Cost Savings for economic life of 15 years:

Propane

\$/Yr Saved x (15 year UPW: 14.16) = LCC \$ Saved

Fuel Oil

\$/Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders to bare costs:

General Conditions: 8.0% Estimating Contingency: 10.0% Contractor's Overhead and Profit: 30.0%

Bond:

1.0%

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH):

5.5%

Allowance for Design Services:

6.0%

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings. Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings. Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO B10 INSTALL AUTOMATIC FLUE DAMPERS ON HEATING SYSTEM BOILERS

Prize Propare Prize Propare Prie Oil Electric Propare Prie Oil Electric Propare Prie Oil Electric Strate	Fac		No. of		ECO B10 Energy Savings:		Automatic Flue Dampers	Dampers						
Committee Explain Ex	Š	Installation Name	Flues		Propane	1-	Electric	Propane	Fuel Oil	\$ CC	Constr	Investment	Payback	SIR
Ober Din Cons (Hacienda) 2 x 8 1 23.5 - 5194.99 - 32,619 \$1,136 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 \$1,146 <th< td=""><td></td><td></td><td>& Dia</td><td>kWH/Yr</td><td>Mil BTU/Y</td><td>Mil BTU/Y</td><td>\$/Yr</td><td>\$/Yr</td><td>\$/Yr</td><td>Saved</td><td>Cost</td><td></td><td>Years</td><td></td></th<>			& Dia	kWH/Yr	Mil BTU/Y	Mil BTU/Y	\$/Yr	\$/Yr	\$/Yr	Saved	Cost		Years	
Fire Station - Office 2 x 15.7 15.7 15.13.44 15.102.99 15.74 15.102.99 15.1748 \$10.082 \$15.102.99 15.1748 \$10.082 \$15.102.99 15.1748 \$10.082 \$15.102.99 15.1748 \$10.082 \$15.102.99 15.1748 \$10.082 \$10.	P 101	Open Din Cons (Hacienda) Club (Bar)	2 x 8"	•	23.5	٠	•	\$184.99		\$2,619	\$1,136	\$1,267	6.85	2.07
Fire Station - Dorm	T 120	Fire Station - Office	2 ×		15.7	•	٠	\$123.44	•	\$1,748	\$1,082	\$1,206	9.77	1.45
Fire Station - Garage Fire Station - Garage Fire Station - Garage Fig. 299 Fig. 288 \$568 Admin Bidg R&D - Electronics 6° 5.7 - \$44.87 - \$582 \$541 Admin Bidg R&D - Electronics 6° - 5.7 - \$44.87 - \$582 \$541 \$54		Fire Station - Dorm	©											
Officers Quarters Military 6° 13.1 - \$102.99 - \$14.56 \$568 Admin Bug RAD. Electronics 6° - 5.7 - \$44.87 - \$681 567 Admin General Purpose 8° - - 28.2 - \$140.25 \$1,933 \$582 Activin Bidg RAD. Electronics 8° - - 28.2 - \$140.25 \$1,933 \$582 A Company HO Building 8° - - 28.3 - \$10.39 \$1,942 \$51 A Company HO Building 8° - - 28.3 - \$10.99 \$1,942 \$582 A Company HO Building 8° - - 28.3 - \$10.99 \$1,942 \$582 A Company HO Building 8° - - 28.3 - \$10.99 \$1,942 \$582 A Company HO Building 8° - - 27.2 - - \$10.99 \$1,942 \$582<		Fire Station - Garage												
Admin Bldg R&D - Office Admin Bldg R&D - Electronics	P 128	Officers Quarters Military	.8	•	13.1	٠	•	\$102.99	•	\$1,458	\$268	\$633	6.15	2.30
Admin Bldg R&D - Electronics 8° 28.2 407.38 \$5614 \$1,164 \$1 Admin Bldg R&D - Electronics A Company HO Building 2 x 8° - 81.8 - \$407.38 \$5,614 \$1,164 \$1 A Company HO Building 8° - - 28.0 - \$139.49 \$1,922 \$582 A Company HO Building 8° - - 28.0 - \$106.94 \$1,474 \$582 A Company HO Building 8° - - 27.2 - \$106.94 \$1,474 \$582 A Company HO Building 8° - - 27.2 - \$106.94 \$1,474 \$582 Brit Barracks w/o Dining 8° - - 27.2 - \$1,896 \$582 A Company HO Building 8° - - \$1,927 \$1,927 \$582 A Company HO Building 8° - - \$1,927 \$1,948 \$582 A Company HO Building 8°	S 197	Admin Bldg R&D - Office	.9	•	5.7	•	•	\$44.87	•	\$635	\$541	\$603	13.44	1.05
Admin General Purpose 8" - 28.2 - \$140.25 \$1,833 \$582 Enlisted Person Maching Enlisted Person Diring Fac 2 x 8" - 61.8 - 5407.36 \$5,614 \$1,164 \$1 Enlisted Person Diring Fac 8" - - 61.8 - - \$407.36 \$5,614 \$1,164 \$1 Enl Barracks w/o Diring 8" - - 28.3 - 510.90 \$1,942 \$582 A Company HO Building 8" - - 28.3 - - \$10.69 \$1,474 \$582 A Company HO Building 8" - - 27.2 - - \$1.39.49 \$1,942 \$582 A Company HO Building 8" - - 27.2 - - \$1.30.4 \$1.80 \$1.474 \$582 A Company HO Building 8" - - 27.2 - - \$1.30.8 \$1.44 \$582 A Company HO Buildin		Admin Bldg R&D - Electronics												
Formpany HQ Building Fac	P 205	Admin General Purpose		•		28.2	٠		\$140.25	\$1,933	\$582	\$649	4.63	2.98
Enlisted Pers Dining Fac 2 x 8"	P 205A													
Kitchen Area - Soullety 8" 28.3 5140.90 \$1,942 \$582 Enl Barracks w/o Diring 8" 28.3 5140.90 \$1,942 \$582 A Company HO Building 8" 27.2 51.5 5106.94 \$1,942 \$582 A Company HO Building 8" 27.2 51.5 51.60.94 \$1,944 \$582 Hith/Drit Clinic w/ Beds 8" 27.2 521.5 5214.28 \$1,944 \$582 Outdoor Swimming Pool 8" 27.2 512.98 \$1,947 \$582 Outdoor Swimming Pool 8" 27.2 512.98 \$1,948 \$582 Outdoor Swimming Pool 8" 27.2 512.98 \$1,949 \$582 Outdoor Swimming Pool 8" 28.1 28.1 \$1,949 \$1,949 \$1,669 Outdoor Swimming Pool 8" 27.2 28.1 \$1,106.98 \$1,940 \$1,669 A Company HO Building 8" 28.4 28.4 51,1050 \$1,948 \$1,680 <	P 206	Enlisted Pers Dining Fac	2 x 8"	•	•	81.8	,	•	\$407.38	\$5,614	\$1,164	\$1,298	3.19	4.33
En I Barracks w/o Dining 8" - - 28.3 - \$140.90 \$1,942 \$562 A Company HQ Building 8" - - 28.0 - \$139.49 \$1,922 \$582 A HChompany HQ Building 8" - - 21.5 - \$106.94 \$1,474 \$582 A HChompany HQ Building 8" - - 27.2 - \$10.00 \$1,620 \$586 A HANDARIC Clinic w/ Beds 8" - 27.2 - \$21.58 - \$1,620 \$586 A Lith/Ont Clinic w/ Beds 8" - 27.2 - \$11.08 \$58.04 \$586 Bulk coor Swimming Pool 8" - 28.1 - \$1.08 \$58.04 \$58.00 Bulk coor Swimming Pool 8" - 28.1 - \$1.08 \$58.00 \$1.09 \$1.99 \$1.94 \$58.00 A Company HQ Building 8" - - 28.4 - \$1.08 \$1.00		Kitchen Area - Scullery												
Company HQ Building 8"	P 207	Enl Barracks w/o Dining	.8	•	•	28.3	•	•	\$140.90	\$1,942	\$582	\$649	4.61	2.99
Finite Barracks w/o Dining 8" 28.0 \$139.49 \$1,922 \$582 Entitle Barracks w/o Dining 8" 21.5 \$106.94 \$1,474 \$582 Entitle w/ Beds 8" 27.2 \$129.83 \$1,034 \$582 Entitle w/ Beds 8" 16.5 \$129.83 \$1,034 \$588 \$541 Entitle w/ Building 8" 16.5 \$129.83 \$1,038 \$541 Entitle w/ Building 8" 10.8 \$128.4 \$1,056 \$582 Entitle and Shop Dining 8" 10.8 \$141.35 \$1,948 \$582 Entitle and Shop Dining 8" 10.8 \$137.19 \$582 Entitle and Shop DIS 8" 10.8 \$137.19 \$582 Entitle and Shop DIS 8" 10.8 \$137.19 \$582 Entitle and Shop DIS 8" 10.8 \$137.19 \$1,379 \$582 Entitle and Shop DIS 8" 10.8 \$137.19 \$1,379 \$582 Entitle and Shop DIS 8" 10.8 \$137.19 \$1,379 \$582 Entitle and Shop DIS 8" 10.8 \$137.19 \$1,379 \$582 Entitle and Shop DIS 8" 10.8	P 207A													
Company HQ Building B" 27.2 . \$106.94 \$1,474 \$582 Hith/Dntt Clinic w/ Beds B" . 27.2 . \$214.28 . \$3,034 \$588 Outdoor Swimming Pool B" . 27.2 . \$129.83 . \$1,808 \$541 Gymnasium G" . 16.5 . \$129.83 . \$1,808 \$541 Physical Fitness Center B" . 28.1 . \$74.16 . \$1,050 \$588 Ent Barracks w/o Dining B" . 28.4 . \$113.6 \$1,948 \$582 A Company HQ Building B" . 28.4 . \$113.6 \$1,948 \$582 Frocess Vehicle Maint Shop DS B" . 10.8 . \$100.11 \$1,379 \$582 Vehicle Maint Shop DRG B" . 20.1 . \$100.11 \$1,379 \$582 Cont Humid Warehouse B" . 17.4 . \$137.9 \$588 Enctron Equip Facility B" . 25.5 . \$20.71 . \$2,442 \$568 En Barracks w/o Dining B" . 25.5 . \$20.071 . \$2,649 \$514 \$518 \$518 \$518 \$519 \$514 \$518 \$519 \$514 \$518 \$519 \$514 \$518 \$519 \$514 \$518 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$519 \$514 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$519 \$514 \$519 \$514 \$519 \$514 \$519 \$519 \$514 \$519 \$514 \$519 \$514 \$519 \$514 \$519 \$514 \$519 \$5	P 208	Enl Barracks w/o Dining	8		•	28.0	•	•	\$139.49	\$1,922	\$582	\$649	4.65	2.96
Hith/Dntl Clinic w/ Beds 8" - 21.5 - \$106.94 \$1,474 \$582 Outdoor Swimming Pool 8" - 27.2 - \$214.28 - \$1,934 \$568 Gymnasium 6" - 16.5 - - \$1,938 \$541 Physical Fitness Center 8" - 9.4 - \$129.83 - \$1,950 \$568 Enl Barracks w/o Dining 8" - 9.4 - \$129.87 \$1,927 \$582 Enl Barracks w/o Dining 8" - - 28.4 - \$141.35 \$1,948 \$582 A Company HQ Building 8" - - 28.4 - \$141.35 \$1,948 \$582 Sig Photo Lab 4" - 10.8 - - \$28.71 \$1,948 \$582 Sig Photo Lab 4" - 18.5 - \$100.11 \$1,379 \$1,948 Vehicle Maint Shop DR 8" -	P 208A							4						
Outdoor Swimming Pool 8° 27.2 \$214.28 \$3,034 \$568 Gymnasium 6° 16.5 5129.83 \$1,050 \$568 Physical Fitness Center 8° 9.4 714.16 \$1,050 \$568 Enl Barracks w/o Dining 8° 28.1 \$141.35 \$1,927 \$582 A Company HQ Building 8° 28.4 \$141.35 \$1,948 \$582 A Company HQ Building 8° 28.4 \$141.35 \$1,948 \$582 Sig Photo Lab 4° 10.8 \$141.35 \$1,948 \$582 Sig Photo Lab 4° 18.5 \$141.35 \$1,948 \$582 Sig Photo Lab 8° 18.5 \$141.35 \$1,948 \$582 Vehicle Maint Shop DS 8° <td< td=""><td>P 210</td><td>Hith/Dntl Clinic w/ Beds</td><td>.8</td><td>1</td><td>•</td><td>21.5</td><td>•</td><td>•</td><td>\$106.94</td><td>\$1,474</td><td>\$582</td><td>\$649</td><td>6.07</td><td>2.27</td></td<>	P 210	Hith/Dntl Clinic w/ Beds	.8	1	•	21.5	•	•	\$106.94	\$1,474	\$582	\$649	6.07	2.27
Gymnasium 6" - 16.5 - \$129.83 - \$1,838 \$541 Physical Fitness Center 8" - 9.4 - \$74.16 - \$1,050 \$568 Enl Barracks w/o Dining 8" - 28.1 - \$139.87 \$1,927 \$582 A Company HΩ Building 8" - 28.4 - \$141.35 \$1,948 \$582 A Company HΩ Building 8" - 10.8 - \$141.35 \$1,948 \$582 A Company HΩ Building 8" - 28.4 - \$141.35 \$1,948 \$582 Sig Photo Lab 4" - 10.8 - \$185.17 - \$1,206 \$531 Process Vehicle Maint Shop DS 8" - 20.1 - \$92.11 \$1,379 \$582 Vehicle Maint Shop ORG 8" - 20.1 - \$137.19 \$1,943 \$568 Cont Humid Warehouse 8" - 9.4 - \$100.11 \$1,942 \$568 Enl Barracks w/o Dining 8" - 25.5 - \$200.71 - \$1408 \$38.80 \$13.059 \$14	P 211	Outdoor Swimming Pool	. 8	-	27.2	•	•	\$214.28	•	\$3,034.	\$568	\$633	2.96	4.79
Physical Fitness Center 8" 94 - \$74.16 - \$1,957 \$568 Enl Barracks w/o Dining 8" - 28.1 - \$139.87 \$1,927 \$582 A Company HQ Building 8" - - 28.4 - \$141.35 \$1,948 \$582 A Company HQ Building 4" - - 28.4 - - \$141.35 \$1,948 \$582 Sig Photo Lab 4" - 10.8 - - \$85.17 - \$1,206 \$531 Process Vehicle Maint Shop DS 8" - - 18.5 - \$92.11 \$1,379 \$582 Vehicle Maint Shop ORG 8" - - 20.1 - \$10.11 \$1,379 \$588 Electron Equip Facility 8" - - 20.1 - \$10.01 \$1,943 \$568 Cont Humid Warehouse 8" - - \$10.1 \$1,048 \$2.868 \$14.08	P 212	Gymnasium	9	•	16.5	•	1	\$129.83	•	\$1,838	\$541	\$603	4.65	3.05
Enl Barracks w/o Dining 8" - - 28.1 - \$139.87 \$1,927 \$582 A Company HQ Building 8" - - 28.4 - - \$141.35 \$1,948 \$582 A Company HQ Building 8" - - 28.4 - - \$141.35 \$1,948 \$582 A Company HQ Building 4" - - - \$141.35 \$1,948 \$582 Sig Photo Lab Process Vehicle Maint Shop DS 8" - - 18.5 - \$100.11 \$1,379 \$582 Vehicle Maint Shop DS 8" - - 18.5 - \$92.11 \$1,269 \$582 Vehicle Maint Shop DS 8" - - 20.1 - \$100.11 \$1,379 \$582 Sectron Equip Facility 8" - - \$137.0 \$1,048 \$5.88 Cont Humid Warehouse 8" - - \$26.8 - \$260.71 - </td <td>P 219</td> <td>Physical Fitness Center</td> <td>.8</td> <td>•</td> <td></td> <td>•</td> <td>٠</td> <td>\$74.16</td> <td>•</td> <td>\$1,050</td> <td>\$568</td> <td>\$633</td> <td>8.54</td> <td>1.66</td>	P 219	Physical Fitness Center	.8	•		•	٠	\$74.16	•	\$1,050	\$568	\$633	8.54	1.66
A Company HQ Building 8" - - 28.4 - \$141.35 \$1,948 \$582 A Company HQ Building 8" - - 28.4 - - \$1,948 \$582 Sig Photo Lab 4" - 10.8 - - \$1,206 \$531 Process Vehicle Maint Shop DS 8" - - 18.5 - - \$92.11 \$1,379 \$582 Vehicle Maint Shop DS 8" - - 20.1 - \$100.11 \$1,379 \$582 Vehicle Maint Shop DS 8" - - 20.1 - \$100.11 \$1,379 \$582 Cont Humid Warehouse 8" - 9.4 - \$1,00.11 \$1,048 \$568 Enl Barracks W/o Dining 8" - 9.4 - \$200.71 - \$2,842 \$588 S - 520.0.71 - \$1,048 \$58.830 \$14.08	P 229	Enl Barracks w/o Dining	.8	•	٠	28.1	•	•	\$139.87	\$1,927	\$582	\$649	4.64	2.97
Enl Barracks w/o Dining 8" - - 28.4 - \$141.35 \$1,948 \$582 A Company HQ Building 4" - 10.8 - \$85.17 - \$1,206 \$531 Sig Photo Lab 4" - 10.8 - \$85.17 - \$1,206 \$531 Process Vehicle Maint Shop DS 8" - - 18.5 - \$1,269 \$582 Vehicle Maint Shop DRG 8" - - 20.1 - \$10.0.1 \$1,379 \$582 Sectron Equip Facility 8" - - 20.1 - \$1,948 \$568 Cont Humid Warehouse 8" - 9.4 - \$1,00.1 \$1,048 \$568 Enl Barracks w/o Dining 8" - 25.5 - \$200.71 - \$2,842 \$588 S 5 - \$20.7 - \$20.0 - \$1,048 \$5.889 -	P 229A													
A Company HQ Building 4" - 10.8 - \$85.17 - \$1,206 \$531 Sig Photo Lab Process - </td <td>P 230</td> <td></td> <td>.8</td> <td>•</td> <td>•</td> <td>28.4</td> <td>•</td> <td>•</td> <td>\$141.35</td> <td>\$1,948</td> <td>\$582</td> <td>\$649</td> <td>4.59</td> <td>3.00</td>	P 230		.8	•	•	28.4	•	•	\$141.35	\$1,948	\$582	\$649	4.59	3.00
Sig Photo Lab 4" - 10.8 - \$85.17 - \$1,206 \$531 Process Vehicle Maint Shop DS 8" - - 18.5 - \$92.11 \$1,269 \$582 Vehicle Maint Shop DRG 8" - 20.1 - \$100.11 \$1,379 \$582 Electron Equip Facility 8" - 17.4 - \$137.19 - \$1,943 \$568 Cont Humid Warehouse 8" - 9.4 - \$74.03 - \$1,048 \$568 Enl Barracks w/o Dining 8" - 25.5 - \$200.71 - \$2,842 \$568 S - - \$137.9 \$14.08 \$38.830 \$13.059 \$14.08	P 230A													
Process Process Process Process Vehicle Maint Shop DS 8" - - 18.5 - - \$92.11 \$1,269 \$582 Vehicle Maint Shop ORG 8" - - 20.1 - \$100.11 \$1,379 \$582 Electron Equip Facility 8" - 17.4 - \$137.19 - \$1,943 \$568 Cont Humid Warehouse 8" - 9.4 - \$74.03 - \$1,048 \$568 Enl Barracks w/o Dining 8" - 25.5 - \$200.71 - \$2,842 \$568 S 0.0 174.3 282.8 \$0 \$1.372 \$1.408 \$38.830 \$13.059 \$14.00	S 238	Sig Photo Lab	4	•	10.8	•		\$85.17	•	\$1,206	\$531	\$292	6.95	2.04
Vehicle Maint Shop DS 8" - 18.5 - \$92.11 \$1,269 \$582 Vehicle Maint Shop ORG 8" - - 20.1 - \$100.11 \$1,379 \$582 Electron Equip Facility 8" - 17.4 - \$137.19 - \$1,943 \$568 Cont Humid Warehouse 8" - 9.4 - \$74.03 - \$1,048 \$568 Enl Barracks w/o Dining 8" - 25.5 - \$200.71 - \$2,842 \$568 S 0.0 174.3 282.8 \$0 \$1.408 \$38.830 \$13.059 \$14.08		Process												
Vehicle Maint Shop ORG 8" - 20.1 - \$100.11 \$1,379 \$582 Electron Equip Facility 8" - 17.4 - \$137.19 \$1,943 \$568 Cont Humid Warehouse 8" - 9.4 - \$74.03 - \$1,048 \$568 Enl Barracks w/o Dining 8" - 25.5 - \$200.71 - \$2,842 \$568 S 0.0 174.3 282.8 \$0 \$1.408 \$38.830 \$13.059 \$1.4	P 252	Vehicle Maint Shop DS	8"	1	•	18.5	•	٠	\$92.11	\$1,269	\$582	\$649	7.05	1.96
Electron Equip Facility 8" - 17.4 - \$1,943 \$568 Cont Humid Warehouse 8" - 9.4 - \$74.03 - \$1,048 \$568 Enl Barracks w/o Dining 8" - 25.5 - - \$200.71 - \$2,842 \$568 S 0.0 174.3 282.8 \$0 \$1.372 \$1.408 \$38.830 \$13.059 \$14.05	P 259	Vehicle Maint Shop ORG	8"	•	•	20.1	•	•	\$100.11	\$1,379	\$585	\$649	6.48	2.13
Cont Humid Warehouse 8" 9.4 - \$74.03 - \$1,048 \$568 Enl Barracks w/o Dining 8" - 25.5 - - \$200.71 - \$2,842 \$568 S 0.0 174.3 282.8 \$0 \$1.408 \$38.830 \$13.059 \$14.05	s 290	Electron Equip Facility	8	•	17.4		٠	\$137.19	•	\$1,943	\$568	\$633	4.62	3.07
Enl Barracks w/o Dining 8" - 25.5 - \$200.71 - \$2,842 \$568 \$1.5	\$ 291	Cont Humid Warehouse	8	•	9.4	•	•	\$74.03	•	\$1,048	\$568	\$633	8.55	1.66
S \$1.408 \$38.830 \$13.059	P 295	Enl Barracks w/o Dining	.8	•	25.5	•	•	\$200.71	•	\$2,842	\$568	\$633	3.16	4.49
	TOTALS			0.0	174.3	282.8	0\$	\$1,372	\$1,408	\$38,830	\$13,059	\$14,561	5.24	2.67

CONSTRUCTION COST ES	TAMITE	Έ		Date Prepared June 1993		Sheet	OF
Project				Project No.	Basis for	Estimate	
EEAP Limited Energy Study				. , 0,000			
Location Limited Energy Stady				1	Code A	(no design comp	eted)
Fort Hunter-Liggett, California							
Engineer-Architect							
Keller & Gannon		Estimato			Checked	D./	
Drawing No. ECO-B10 Install Automatic Flue Dam	nere		" RJB		Cilecked	BIH	
ECO-BTO ITIStall Automatic Fide Dani		antity		abor	,	Material	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
GAS FIRED HEATERS							
4-inch Diameter Auto-Damper	1	Ea	32.00	\$32	\$134	\$134	\$166
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 4-inch Flue, Gas Fired							\$346
General Conditions 8%							\$28
Contractor O.H. & P 30%							\$104
Sub Total							\$478
Bond 1%							\$5
Sub Total						1	\$483
Estimating Contingency 10%							\$48
Total Probable Construction Cost							\$531
6-inch Diameter Auto-Damper	1	Ea	34.90	\$35	\$138	\$138	\$173
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 6-inch Flue, Gas Fired							\$353
General Conditions 8%							\$28
Contractor O.H. & P 30%							\$106
Sub Total							\$487
Bond 1%							\$5
Sub Total							\$492
Estimating Contingency 10%							\$49
Total Probable Construction Cost							\$541
8-inch Diameter Auto-Damper	1	Ea	38.40	\$38	\$152	\$152	\$190
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 8-inch Flue, Gas Fired							\$370
General Conditions 8%							\$30
Contractor O.H. & P 30%							\$111
Sub Total							\$511
Bond 1%							\$5
Sub Total							\$516
Estimating Contingency 10%							\$52
Total Probable Construction Cost							\$568

				Date Prepared		Sheet C)F
CONSTRUCTION COST ES	TAMIT	Ε		June 1993	3		
Project			-	Project No.	Basis for	Estimate	
EEAP Limited Energy Study							
Location					Code A	(no design compe	ted)
Fort Hunter-Liggett, California Engineer-Architect					-		
Keller & Gannon							
Drawing No.		Estimato	r		Checked	Ву	
ECO-B10 Install Automatic Flue Dam	pers		RJB			BIH	
Line Item	Que No.	Unit	Per La	abor	Per	Aaterial	Total
Line item	Units	Meas.	Unit	Total	Unit	Total	Cost
OIL FIRED HEATERS							
4-inch Diameter Auto-Damper	1	Ea	32.00	\$32	\$156	\$156	\$188
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 4-inch Flue, Oil Fired							\$368
General Conditions 8%							\$29
Contractor O.H. & P 30%							\$29
Sub Total							\$426
Bond 1%							\$4
Sub Total							\$431
Estimating Contingency 10%							\$43
Total Probable Construction Cost							\$474
6-inch Diameter Auto-Damper	1	Ea	34.90	\$35	\$161	\$161	\$196
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 6-inch Flue, Oil Fired							\$376
General Conditions 8%							\$30
Contractor O.H. & P 30%							\$113
Sub Total							\$519
Bond 1%							\$5
Sub Total							\$524
Estimating Contingency 10%							\$52
Total Probable Construction Cost							\$576
8-inch Diameter Auto-Damper	1	Ea	38.40	\$38	\$161	\$161	\$199
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 8-inch Flue, Oil Fired			-	Ţ. <u>-</u>		+==+	\$379
General Conditions 8%				<u> </u>			\$30
Contractor O.H. & P 30%	- 						\$114
Sub Total	+						\$524
Bond 1%							\$5
Sub Total							\$529
Estimating Contingency 10%						 	Ψ <u>529</u> \$53
Total Probable Construction Cost	+	\vdash			 		\$582
TOTAL FIODADIS CONSTITUCTION COST		1l			1		Φ 202

ECO B15

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location: Project Title	Fort Hunter Lig	gett, California nergy Improvements	Region No. 4		Project No. Fiscal Year FY95
•	rtion Name:			Systems to Variable Air	
	ate: June 1993	200 813 0011	Economic Life:	•	Preparer: KELLER & GANNON
1. Investme	ent Costs			•	
A. Construc			\$122,292		
B. SIOH			\$6,726		
C. Design C	Cost		\$7,338		
•	st (1A+1B+1C)		\$136,355		
	Value of Existing E	guipment	4	\$0	
	tility Company Reb			\$0	_
	restment (1D-1E-1F				_ \$136,355
G. Total III	esument (10 TE 17	,			V 100,000
2. Energy S	Savings (+)/Cost(-):				
Date of NIS	TIR 85-3273-X Use	d for Discount Facto	ors: October 1992		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$18.23	863.6	\$15,743	11.70	\$184,188
B. Dist	\$4.98	0	\$0	13.78	\$0
C. Propane	\$7.87	0		14.16	\$0
D. Other	NA	0		NA	NA
E. Demand	Savings		= \$0	11.70	\$ 0
F. Total	3 -	864	\$15,743		\$184,188
3. Non Ene	rgy Savings (+) or	Cost (-):		•	
A Annual R	Recurring (+/-)		(\$1,000)		
	t Factor (Table A)		(4.1,4.4.)	11.12	
. ,	ited Savings/Cost (3A x 3A1)			(\$11,120)
B. Non Rec	curring Savings (+)	or Cost (-)			
ltem	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a.	\$0	15	0.56	\$0	
b.	\$0	15	0.56	\$0	
C.	\$0	15	0.56	\$0	
d. Total	\$0	0	0.00	\$0	
C Total Nor	n Energy Discounte	ed Savings (3A2+3E	3d4)	(\$11,120)	
4 Simple B	layback 1G//2E2±2	A+(3Bd1/Economic	o Life)):	9.25	Years
	ayback 1G/(2F3+3 t Discounted Saving		C Life)).		rears
				\$173,068 1.27	
_	to Investment Ratio				
r. Adjusted	Internal Rate of Re	uurn (AIHH):		5.67%	

ECO B15:

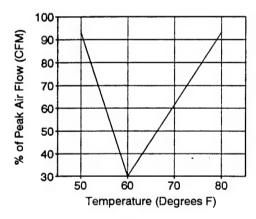
CONVERT MULTIZONE HVAC SYSTEMS TO VARIABLE AIR VOLUME

Large barracks buildings 205, 207, 208, 229 and 230 are served by dual duct, multizone central HVAC systems. Operation of hot and cold decks simulataneously has been precluded by a past controls modification. The existing controls allow simultaneous operation in only the heating or cooling mode.

Energy Savings Calculations

Energy savings can be achieved by removing existing dual duct mixing boxes and controls and replacing them with variable air volume boxes and controls. Energy savings are achieved by scheduling constant temperature supply air at air flow rates corresponding to the heating or cooling load.

As shown below, the variable air volume system saves fan energy during all times of the year except when the system is at full load heating or cooling mode. (Note: Air flow rates are proportional to fan power.)



Barracks buildings are assumed to be dominated by external HVAC loads. Thus, the required air flow will track with the outside air temperature.

The following schedule is derived from local weather data to approximate the air flow rates to be provided by the VAV system during different outside air temperatures ranges.

Temperature	Percent of	Percent of	VAV Fan Load
Range	Total CFM	Year at Load	per Temp Range
over 80 Degrees	100%	7%	7%
60 to 80 Degrees	80%	52%	42%
30 to 50 Degrees	40%	40%	16%
below 30 Degrees	100%	1%	1%
Weighted average VAV Fan Energy	of Existing Us	e:	66%

Only fan energy is saved, thus, baseline fan energy use is reduced to 66% of the existing system use. Refer to attached tabular calculations.

Annual energy cost savings are based on fuel savings calculations as explained above:

Electricity

kWH/Yr Saved x 0.003413 MBTU/kWH x \$18.23/MBTU = \$/Yr Saved

ECO B15:

CONVERT MULTIZONE HVAC SYSTEMS TO VARIABLE AIR VOLUME

Life Cycle Energy Cost Savings for economic life of 15 years:

Electricity

\$/Yr Saved x (15 year UPW: 11.70) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders to bare costs:

General Conditions: 8.0%
Estimating Contingency: 10.0%
Contractor's Overhead and Profit: 30.0%
Bond: 1.0%

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH): 5.5%
Allowance for Design Services: 6.0%

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO - B15 Convert Multizone HVAC System to Variable Air Volume

SIR		.31	1.26	1.26	.38	.14	.27
Pay-	Back	8.95 1.31	9.34	9.34	8.49	10.32	9.25 1.27
Constr. Investment Pay-	€9	\$27,271	\$27,271	\$27,271	\$27,271	\$27,271 10.32 1.14	\$136,355
Constr.	Cost \$	\$24,458	\$24,458	\$24,458	\$24,458	\$24,458	\$122,292
t Saved	\$CC\$	(\$2,224)	(\$2,224)	(\$2,224)	(\$2,224)	(\$2,224)	253,018 \$15,743 \$184,188 (\$1,000) (\$11,120) \$122,292
O&M Cos	\$/Yr	(\$200)	(\$200)	(\$500)	(\$200)	(\$200)	(\$1,000)
Savings Energy Cost Saved O&M Cost Saved	\$227	\$37,973	\$36,513	\$36,513	\$39,921	\$33,267	\$184,188
Energy C	\$/Yr	\$3,246	\$3,121	\$3,121	\$3,412	\$2,843	\$15,743
Savings	kW hr / Yr	52,164	50,158	50,158	54,839	45,699	253,018
Full Load VAV System	kW hr / Yr.	101,260	97,365	92,365	106,453	88,710	491,153
Full Load	SA Fan RA Fan kW hr / Yr kW hr / Yr.	153,424	147,523	147,523	161,292	134,410	744,171
SC	RA Fan	23	21	12	53	22	Totals
Fan Amps	SA Fan	55	54	54	29	46	
Fac.	ş.	205	207	208	229	230	

Annual Full Load Energy Consumption was calculated from measured phase voltage readings and operating hours of the

Full load kWHr / Year consumption of supply and return fans are reduced to 66% of existing usage due to the proposed VAV retrofit.

Energy cost savings are based on the year-round, continuous usage rate for power.

Annual O&M efforts for VAV system components are expeced to require an additional 5 MH per year of effort. At \$40 per hour, annual cost per building VAV sytem is \$200.

CONSTRUCTION COST EST	MAT	E		Date Prepared June 1993	1	Sheet Of	
Project				Project No.	Basis for	 Estimate	
EEAP Limited Energy Study							
Location					Code A	(no design comp	eted)
Fort Hunter-Liggett, California							
Engineer-Architect							
Keller & Gannon Drawing No.		Estimate	or		Checked	Ву	
ECO-B9 Convert Multizone to VAV			JCS			BIH	
		antity	Des	Labor	Per	Material	Tatal
Line Item	No. Units	Unit Meas.	Per Unit	Total	Unit	Total	Total Cost
Buildings 205, 207, 208, 229 & 230 (Typ	ical fo	r Eacl	n)				
Double-Duct VAV Box with T-stat	8	EA	\$300	\$2,400	\$650	\$5,200	\$7,600
and duct static pressure sensor							
20 HP Variable Frequency Drive	1	LS		\$1,200	_	\$3,000	\$4,200
installed w/ actuator							
Remove Constant Volume Mixing Boxe	8	LF	\$250	\$2,000	-	\$0	\$2,000
Testing and Balancing	1	LS	-	-	-	-	\$1,880
Subtotal							\$15,680
General Conditions @ 8%							\$1,25
Subtotal							\$16,934
Contractor OH & Profit @ 30%							\$5,080
Subtotal							\$22,015
Bond @ 1%							\$220
Subtotal							\$22,23
Estimating Contingency @ 10%							\$2,223
Total Probable Construction Cost							

ECO B21

Location: Project Title:	Fort Hunter Ligg ECIP Facility Ene	rgy Improvements	Region No.	4		Project No. Fiscal Year FY95
		21 Replace Inefficie	nt Bollers Economic L	ifor 15	YEARS	Preparer: KELLER & GANNON
Analysis Date	e: June 1993		ECONOMICE	ile. 15	ILANO	riepaiei. Keelen & GANNON
1. Investmen	t Costs					
A. Construct			\$28,061			
B. SIOH			\$1,543			
C. Design Co	ost		\$1,684			
	t (1A+1B+1C)		\$31,288	3	40	
	alue of Existing E				\$0 \$0	_
	ity Company Reba			-	D U	\$31,288
G. Total Inve	estment (1D-1E-1F))				\$61,250
2. Energy Sa	avings (+)/Cost(-):					
Date of NIST	TR 85-3273-X Use	d for Discount Factor	s: October 1992			
Enorgy	Cost	Saving	Annual \$		Discount	Discounted
Energy Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)		Factor(4)	Savings(5)
Cource	ψ,ισο,()		3 ()			3 ()
A. Elec.	\$21.84	0.0	\$0		11.70	\$0
B. Dist	\$4.98	0.0	\$0	•	13.78	\$0
C. Propane	\$7.87	506.1	\$3,983	•	14.16	\$56,397
D. Demand	\$108.60	0.0	kW \$0	•	11.70	\$0
E. Other						
F. Total		506	\$3,983			\$56,397
3. Non Ener	gy Savings (+) or	Cost (-):		- 		
A Annual D	ocurring (±/-)		\$0			
	ecurring (+/-) Factor (Table A)				11.12	
	ed Savings/Cost (3A x 3A1)				\$0
(-)		·				
B. Non Recu	ırring Savings (+)	or Cost (-)				
Item	Savings(+)	Year of	Discount		Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)		ings(+)Cost(-)(4)	
a.			-			•
b.			-			•
c. d. Total						:
u. Total						
C Total Non	Energy Discounte	ed Savings (3A2+3Bo	d4)		\$0	
4. Simple Pa	ayback 1G/(2F3+3	3A+(3Bd1/Economic	Life)):		7.9	Years
	Discounted Saving			•	\$56,397	
	o Investment Ratio				1.80	
	Internal Rate of Re				8.17%	

ECO B21: REPLACE INEFFICIENT BOILERS

This measure is developed to evaluate the potential energy savings created by the replacement of older, low efficiency boilers with new, high efficiency boilers.

Energy Savings Calculations

Energy savings are achieved by raising the boiler/heater efficiency. Fuel savings are determined based on baseline fuel use and the difference between existing and proposed new boiler efficiencies. Baseline energy use and system efficiency determinations are provided in: "EEAP Limited Energy Study for Fort Hunter Liggett", dated 1993. Savings are calculated as follows:

Qs = Qo x (Existing Efficiency | (New Efficiency))

where: Qs = Fuel Savings

Qo = Baseline fuel use (after implimentation of envelope and HVAC ECO's

with SIR's over 1.0)

Efficiency System efficiencies for existing and new boilers

Annual energy cost savings are based on fuel savings calculations as explained above:

Propane MBTU/Yr Saved x \$ 7.87/MBTU = \$/Yr Saved Fuel Oil MBTU/Yr Saved x \$ 4.98/MBTU = \$/Yr Saved

Life Cycle Energy Cost Savings for economic life of 15 years:

Propane \$/Yr Saved x (15 year UPW: 14.16) = LCC \$ Saved Fuel Oil \$/Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders to bare costs:

General Conditions: 8.0%. Estimating Contingency: 10.0% Contractor's Overhead and Profit: 30.0% Bond: 1.0%

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH): 5.5% Allowance for Design Services: 6.0%

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO B21: REPLACE INEFFICIENT BOILERS

nstallation Name Open Din Cons Hacienda Clu Bar Hacienda, Dwellings Electron E uip Facility	Fac		Boiler System Data	tem Data		Existing	Boiler	Existing Boiler System Losses	9886			
Open Din Cons Hacienda Clu Bar Hacienda, Dwellings Electron E uip Facility	Š	nstallation Name	Fuel	System	Capacity	Firing	Auxil-	Firing Auxil- Radiant Convec- Shut Genri	Convec	Shut	Genri	Net
Open Din Cons Hacienda Clu Bar Hacienda, Dwellings Electron E uip Facility			Nsed	Туре	втин	盂	liany		tion	tion Down Cond	Cond	#
Open Din Cons Hacienda Clu Bar Hacienda, Dwellings Electron E uip Facility												
Clu Bar Hacienda, Dwellings Electron E uip Facility	P 101	Open Din Cons Hacienda	Propane	Propane AHU-HWB/C	300,000 82.9%	82.9%		6.0%	4.0% 2.0% 3.0% 67.9%	2.0%	3.0%	67.9%
Hacienda, Dwellings Electron E uip Facility		Clu Bar										
Electron E uip Facility		Hacienda, Dwellings	Electric	ER-PH	30 x 3kW	•		,	٠	٠		•
	\$ 290	Electron E uip Facility	Propane	Propane AHU-PROP/C	1,020,000 80.8%	80.8%		8.0%	4.0% 2.0% 3.0% 63.8%	2.0%	3.0%	63.8%
Detached Latrine/Shower	P 642	Detached Latrine/Shower	Propane	Propane HWH/TK-Circ	180,000 75.2%	75.2%	•	7.0%	4.0%	2.0% 3.0% 59.2%	3.0%	59.2%

ECO B21: REPLACE INEFFICIENT BOILERS

													The second secon			-
Fac		New Bo	oiler Syst	New Boiler System Losses	38				Econom	Economic Analysis	-					
Š	Installation Name	Firing		Radiant	Auxil- Radiant Convec- Shut Genni	Shut	Gend	Net	E#	Energy Energy Annual	Energy	Annual	227	Constr	Invest-	
		E#	liany		tion	Down Cond	Cond		Eff Added	Usage	Savings	Cost	Saved	Cost	ment	
										MBtu/Yr MBtu/Yr Saved \$	MBtu/Yr	Saved \$	₩	₩.	₩.	SIR
101	en Din Cons acienda	94.0%		4.0%	2.0%	2.0%	1.0%	85.0%	17.1%	2.0% 1.0% 85.0% 17.1% 1,064.0	214	214 \$1,685	\$23,854	\$6,941	62'2\$	3.1
	Clu Bar															
	acienda, Dwellings		1		٠	•	•	-								
S 290	Electron E ui Facility	94.0%	1	4.0%	2.0%	2.0%	1.0%	1.0% 85.0% 21.2%	21.2%	741.5	185	185 \$1,455	\$20,609	\$20,609 \$15,793 \$17,609	\$17,609	1.2
642	Detached Latrine/Shower	0.94		0.04	0.02	2.0%	1.0%	2.0% 1.0% 85.0% 25.9%	25.9%	116.7	107	\$843	\$11,934	\$5,327	\$5,940	2.0
							Totals		-		506	506 \$3 983	\$56.397	\$56.397 \$28.061 \$31.288	\$31 288	#

CONOTRUCTION COST EST	BAAT			Date Prepared		Sheet Of	···
CONSTRUCTION COST EST	IVIAI	<u></u>					
Project				Project No.	Basis for Esti	mate	
EEAP Limited Energy Study					Code A (no	design competed	1)
Fort Hunter-Liggett, California			•				•
Engineer-Architect							
Keller & Gannon							
Drawing No.		Estimate	OF .		Checked By		
ECO B21 REPLACE INEFFICIENT BOIL				abor	Mate		
Line Item	No.	antity Unit	Per	abor	Per	r iai	Total
2.0	Units	Meas.	Unit	Total	Unit	Total	Cost
BUILDING 101				1	I	11	
Demolish existing boiler	1	EA	\$750	\$750		\$0	\$750
Provide & Install 300,000 BTUH Boiler	1	EA	\$1,050	\$1,050	\$2,650	\$2,650	\$3,700
			Ψ1,000	Ψ1,000	ΨΣ,000	\$2,000	\$4,450
Subtotal 98%							\$356
General Conditions @ 8%							\$4,806
Subtotal							\$1,442
Contractor OH & Profit @ 30%							\$6,248
Subtotal		 					\$62
Bond @ 1%		1			 		
Subtotal						 	\$6,310
Estimating Contingency @ 10%		<u> </u>	- 4	<u> </u>			\$631
Total Probable Construction Cost	1	1	T		1	1	\$6,941
		-			<u> </u>		
		-					
		 					
BUILDING 290							
Demolish existing boiler	1	EA	\$1,200	\$1,200		\$0	
Provide & Install 1,020,000 BTUH Boile	1	EA	\$1,675	\$1,675	\$7,250	\$7,250	\$8,925
Subtotal							\$10,125
General Conditions @ 8%							\$810
Subtotal							\$10,935
Contractor OH & Profit @ 30%							\$3,281
Subtotal							\$14,216
Bond @ 1%							\$142
Subtotal							\$14,358
Estimating Contingency @ 10%							\$1,436
Total Probable Construction Cost							\$15,793

CONSTRUCTION COST EST	IMAT	E		Date Prepared June 19	93	Sheet Of	
Project				Project No.	Basis for Esti	mate	
EEAP Limited Energy Study							
Location					Code A (no	design competed)
Fort Hunter-Liggett, California							
Engineer-Architect							
Keller & Gannon		I Fatimata			Checked By		
Drawing No.	EDO	Estimato	т		Checked by		
ECO B21 REPLACE INEFFICIENT BOIL	EHS	antity	ء ا	bor	Mate	arial	
Line Item	No. Units	Unit Meas.	Per Unit -	Total	Per Unit	Total	Total Cost
BUILDING 642							
Demolish existing boiler	1	EA	\$750	\$750		\$0	\$750
Provide & Install 180,000 BTUH Boiler	1	EA	\$840	\$840	\$1,825	\$1,825	\$2,665
Subtotal							\$3,415
General Conditions @ 8%							\$273
Subtotal							\$3,688
Contractor OH & Profit @ 30%							\$1,106
Subtotal							\$4,795
Bond @ 1%							\$48
Subtotal							\$4,843
Estimating Contingency @ 10%			***				\$484
Total Probable Construction Cost							\$5,327

ECO C2

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

Location: Project Title:	ECIP Facility Er	ggett, California nergy Improvemer	Region No. 4	Fi	oject No. scal Year FY95
Analysis Date:		2 Heplace Pipe in	sulation on Domestic Economic Life: 1	5 YEARS Pr	eparer: KELLER & GANNON
1. Investment C A. Construction B. SIOH	osts Costs		\$655 \$36 \$39		
C. Design Cost D. Total Cost (1	A+1B+1C)		\$730 -		
E. Salvage Valu				\$0 \$0	
F. Public Utility G. Total Investn				Ψ0	
G. 75tm 1175-117	,				
2. Energy Savin Date of NISTIR	ngs (+)/Cost(-): 85-3273-X Used	I for Discount Fac	tors: October 1992		
Energy Source	Cost \$/MTBU/(1)	Saving MBTU/YR(2)	Annual \$ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec. B. Dist C. Propane D. Demand E. Other	\$21.84 \$4.98 \$7.87 \$108.60	0.0 35.1 14.9 0.0 k	\$0.00 \$174.80 \$117.26 W \$0.00	11.70 13.78 14.16 11.70	\$0 \$2,409 \$1,660 \$0
F. Total			\$292.06		\$4,069
3. Non Energy	Savings (+) or	Cost (-):			
A. Annual Recu	rring (+/-)		\$0	. 11.12	\$ 0
B. Non Recurrin	ng Savings (+)	or Cost (-)			
item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Sav- ings(+)Cost(-)(4	
a. b. c.					
d. Total					
C Total Non En	ergy Discounte	d Savings (3A2+3	BBd4)	\$0	
5. Total Net Dis 6. Savings to Ir	ack 1G/(2F3+3 counted Saving ovestment Ratio ernal Rate of Re	(SIR) 5/1G:	nic Life)):	2.5 \$4,069 5.57 16.62%	Years

ECO C2: REPLACE PIPE INSULATION ON DOMESTIC HOT WATER SYSTEMS

Domestic hot water (DHW) system piping needing replacement insulation is listed by building on the attached tabular summary.

Thermal losses result from uninsulated piping. Energy savings are achieved when such pipes are insulated.

Energy Saving Calculations

For the purposes of analysis, DHW systems are divided into two types:

- 1. Non-Circulated DHW Systems
- 2. Circulated DHW Systems

Non-Circulated DHW Systems:

Non-circulating DHW systems are typically installed in residences and office type buildings. Hot water from the water heater or tank sits motionless in piping until a faucet or other valve is opened. Standing hot water looses heat to the ambient air over time as characterized by the following equation:

$$T = To + (Ti - To) e^{(-t/[Ct/Ut])}$$

where:

T = Temperature at time increment t

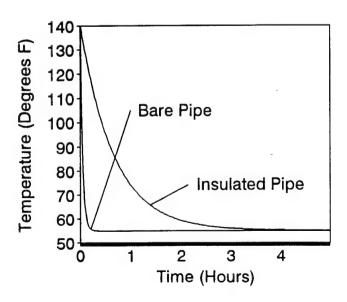
To = Ambient temperature, assumed to be 55 Degrees F

Ti = Initial temperature, taken to be the DHW heater set point temperature

t = Elapsed time

Ct = Heat capacity of water (1 BTU/Degree F)

Ut = Conductance of pipe and insulation (if any) (BTU/Hr-Degree F)



ECO C2: REPLACE PIPE INSULATION ON DOMESTIC HOT WATER SYSTEMS

Two questions arrise:

- 1. How long does it take the water in the piping to cool to an unacceptable level?
- 2. Does adding insulation effect this time significantly?

Review of the above plot and evaluation of the above equation for a bare pipe results in a time of about 6.6 minutes for water to cool from a temperature of 140 Degrees F to 90 Degrees F.

Review of the above plot and evaluation of the above equation for an insulated pipe results in a time of about 35 minutes for water to cool from a temperature of 140 Degrees F to 90 Degrees F.

Thus, if water demand is no more frequent than every 1/2 hour, insulation will not make a difference.

Circulated DHW Systems:

Hot water is circulated continuously through the piping system. Water temperature is maintained at or near the water heater set point. Heat transfer is steady state, unlike non-circulated systems.

Tabular calculations for circulated system heat losses follow this narrative.

Field investigation indicates that most pipes are insulated already, and that only a few repairs are required.

This ECO is evaluated assuming DEH has reset all water heater temperatures to authorized levels.

Pipe Heat Loss (Gain) Calculations

The attached tabular calculations are performed as follows:

Size In-Dia.:

Nominal pipe size, diameter in inches

Length LF:

Pipe length needing insulation, linear feet

Energy savings are determined for each pipe size and service type by using nomographs developed by the U.S. Department of Energy (DOE) from their publication: "Energy Conservation in Existing Buildings", February 1980.

Use of the nomographs results in a heat loss rate of: BTUH per LF for "Bare" pipe and for insulated piping. For the purposes of these calculations, it is assumed that 1-inch of insulation is applied.

Bare Pipe:

Heat loss for bare pipe determined from the DOE nomograph

Insulated Pipe:

Heat loss for insulated pipe (1-inch thickness) determined from the

DOE nomograph

ECO C2: REPLACE PIPE INSULATION ON DOMESTIC HOT WATER SYSTEMS

Boiler Efficiency: Domestic Hot Water system boiler efficiency determined based on

measurements of combustion efficiency and a field assessment of existing conditions. (Not displayed) Efficiency is applied to heat

loss rates to determine fuel use.

Savings:

Listed separately for Fuel Oil and for Propane; is the difference

between heat losses for bare and insulated piping.

Energy Cost Savings

Annual and life cycle energy cost savings are determined as follows:

Annual Energy Cost Savings:

Propane

MBTU/Yr Saved x \$ 7.87/MBTU = \$/Yr Saved

Fuel Oil

MBTU/Yr Saved x \$ 4.98/MBTU = \$/Yr Saved

Life Cycle Energy Cost Savings for economic life of 15 years:

Propane

\$/Yr Saved x (15 year UPW: 14.16) = LCC \$ Saved

Fuel Oil

\$/Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders:

General Conditions:

8.0%

Estimating Contingency:

10.0%

Contractor's Overhead and Profit:

30.0%

Bond:

1.0%

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH):

5.5%

Allowance for Design Services:

6.0%

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO C2 REPLACE PIPE INSULATION ON DOMESTIC HOT WATER SYSTEMS

Analysis of Circulated Domestic Hot Water Energy Savings

No. DHW Size Length Pipe Loss Fuel Oil Propane Fuel Oil Propane Fuel Oil Propane LCC Bare Cos Investmen Pay- SIR 207 Tem In Dia LF Mil BTU/Yr Mil BTU/Y \$\psi/r \$\psi/r Savings \$\psi/r	Fac	Bas	Baseline		Bare	Insulated	ECO #	ECO #2 Energy Savings	avings						
Tem In Dia LF Mil BTU/Y	No.	H	Size	Length	Pipe L		Fuel Oil	Propane	Fuel Oil	Propane		Bare Cos	Investmen		SIR
105 2 10 55.5 42.4 13.1 - \$65 \$0 \$899 \$100 \$174 2.67 105 2 10 46.5 35.5 11.0 - \$55 \$0 \$755 \$100 \$174 3.17 105 2 10 45.9 34.9 11.0 - \$55 \$0 \$755 \$100 \$174 3.17 105 1 10 19.3 0.0 - 7.0 \$55 \$780 \$60 \$104 1.89 105 1 10 14.2 0.0 - 7.9 \$174.80 \$17.2 \$4,069 \$420 \$730 2.50		Tem	드	4	Mil BTU/Yr	Mil BTU/Yr	Mil BTU/Y	Mil BTU/Y	\$/₹	_	Savings	↔	49	Back	
105 2 10 46.5 35.5 11.0 - \$55 \$0 \$755 \$100 \$174 3.17 105 2 10 45.9 34.9 11.0 - 7.0 \$55 \$780 \$60 \$174 3.17 105 1 10 19.3 0.0 - 7.0 \$65 \$780 \$60 \$104 1.89 105 1 10 14.2 0.0 - 7.9 \$17.26 \$4,069 \$420 \$730 2.50	207	105	2	10	55.5	42.4	13.1		\$65	\$0	668\$	\$100	\$174	2.67	5.17
105 2 10 45.9 34.9 11.0 - \$55 \$0 \$755 \$100 \$174 3.17 105 1 10 19.3 0.0 - 7.0 \$0 \$65 \$880 \$60 \$104 1.89 105 1 10 14.2 0.0 - 7.9 \$60 \$880 \$60 \$104 1.68 105 1 10 14.2 0.0 - 7.9 \$17.4.80 \$17.26 \$4,069 \$420 \$730 2.50	229	105	2	10	46.5	35.5	11.0		\$55	\$0	\$755	\$100	\$174	3.17	4.34
105 1 10 19.3 0.0 - 7.0 \$0 \$55 \$780 \$60 \$104 1.89 105 1 10 14.2 0.0 - 7.9 \$62 \$880 \$60 \$104 1.68 105 1 10 14.2 0.0 - 7.9 \$174.80 \$117.26 \$4,069 \$420 \$730 2.50	230	105	2	10	45.9	34.9	11.0	ı	\$55	\$0	\$755	\$100	_	3.17	4.34
105 1 10 14.2 0.0 - 7.9 \$0 \$62 \$880 \$60 \$104 Totals 35.1 14.9 \$174.80 \$117.26 \$4,069 \$420 \$730 \$730 \$4,060 <td< th=""><th>S 238</th><th>105</th><th>-</th><th>10</th><th>19.3</th><th>0.0</th><th>-</th><th>7.0</th><th>\$0</th><th>\$55</th><th>\$780</th><th>09\$</th><th>\$104</th><th>1.89</th><th>7.48</th></td<>	S 238	105	-	10	19.3	0.0	-	7.0	\$0	\$55	\$780	09\$	\$104	1.89	7.48
35.1 14.9 \$174.80 \$117.26 \$4,069 \$420 \$730	S 290	105	-	10	14.2	0.0	,	7.9	\$0	\$62	\$880	09\$	\$104	1.68	8.44
						Totals	35.1	14.9	\$174.80	\$117.26		\$420	\$730	2.50	5.57

				Date Prepare	d	Sheet of	
CONSTRUCTION COST ES	TIMAT	E		June 19	93		
Project				Project No.	Basis for	Estimate	
EEAP Limited Energy Study							
Location					Code A	(no design compe	eted)
Fort Hunter-Liggett, California Engineer-Architect			-				
Keller & Gannon							
Drawing No.		Estimat	tor	1.57	Checked	Ву	
ECO C2: Replace Pipe Insulation			RJB			BIH	
Line Item	Qui	antity Unit	Per	Labor	Per	Material	Total
Line Rem	Units	Meas.	Unit	Total	Unit	Total	Cost
Building 207							
2" Pipe Insulation	10	LF	\$6.00	\$6	50 \$4.00	\$40	\$100
Subtotal Bldg 207							\$100
				<u> </u>		1	
Building 229							
2" Pipe Insulation	10	LF	\$6.00	\$6	\$4.00	\$40	\$100
Subtotal Bldg 229							\$100
Building 230							
2" Pipe Insulation	10	LF	\$6.00	\$6	\$4.00	\$40	\$100
Subtotal Bldg 230							\$100
Building 238							
1" Pipe Insulation	10	LF	\$4.00	\$4	10 \$2.00	\$20	\$60
Subtotal Bldg 238							\$60
Building 290							
1" Pipe Insulation	10	LF	\$4.00	\$4	\$2.00	\$20	\$60
Subtotal Bldg 290							\$60
Subtotal							\$420
General Conditions @ 8%							\$34
Subtotal							\$454
Contractor OH & Profit @ 30%							\$136
Subtotal							\$590
Bond @ 1%							\$6
Subtotal							\$596
Estimating Contingency @ 10%							\$60
Total Probable Construction Cost							\$655

ECO C-3

Location:	Fort Hunter Ligg		Ŗ	egion No. 4			Project No.
Project Title:	ECIP Facility Ener	gy improvements	01	T			Fiscal Year FY95
-		3 Insulate Hot Wate			4-	VEADO	Promoter KELLER & CANING
Analysis Date	e: June 1993		E	conomic Life:	15	YEARS	Preparer: KELLER & GANNO
1. Investment	Costs				_		
A. Constructi	on Costs			\$4,578	-		
B. SIOH				\$252	_		
C. Design Cost				\$275	_		
_	(1A+1B+1C)			\$5,105	=		
	alue of Existing Ed	uipment				\$0	
F. Public Utility Company Rebate						\$0	
G. Total Investment (1D-1E-1F)							\$5,105
	, ,						
2 Energy Sa	vings (+)/Cost(-):						
Date of NIST	R 85-3273-X Used	for Discount Factor	rs: Octo	ober 1992	-		
	Cost	Saving	Δ	nnual \$		Discount	Discounted
Energy	\$/MTBU/(1)	MBTU/YR(2)		avings(3)		Factor(4)	Savings(5)
Source	\$/M160/(1)	MBTO/TH(2)	0	aviiigs(o)		1 40101(4)	oavings(o)
A. Elec.	\$18.23	9.2		\$167.72		11.70	\$1,962
B. Dist	\$4.98	48.3	-	\$240.30		13.78	\$3,311
C. Propane	\$7.87	46.1		\$362.54	•	14.16	\$5,134
D. Demand	\$108.60	0.0	kW	\$0.00		11.70	\$0
E. Other	4100.00		=	•			•
F. Total			_	\$770.56	=		\$10,407
3 Non Energ	y Savings (+) or (Cost (-):					
O. NOTE ETTERS	y cavings (1) or t				-		
A. Annual Recurring (+/-)				\$0	_		
(1) Discount Factor (Table A)						11.12	
(2) Discounte	ed Savings/Cost (3	3A x 3A1)					\$0
B. Non Recu	rring Savings (+)	or Cost (-)					
14	Covings(1)	Year of	D	iscount		Discounted Sav-	
Item	Savings(+)			actor(3)		ings(+)Cost(-)(4)	
	Cost(-)(1)	Occur. (2)	Γ.	acior(3)		111gs(+)00st(-)(+)	
a.		_	-				
b.		_		-			
C.					_		•
d. Total							
C Total Non	Energy Discounted	d Savings (3A2+3Bo	d 4)			\$0	
4. Simple Pa	vback 1G/(2F3+3/	A+(3Bd1/Economic	Life)):			6.6	Years
5. Total Net Discounted Savings (2F5+3C):						\$10,407	
6. Savings to Investment Ratio (SIR) 5/1G:						2.04	
7. Adjusted Internal Rate of Return (AIRR):						9.06%	,
		\ /					

ECO C3: INSULATE HOT WATER STORAGE TANKS

Thermal losses result from uninsulated hot water storage tanks. Energy savings are achieved when the tanks are insulated.

Energy savings are determined for the domestic hot water tanks by using nomographs developed by the U.S. Department of Energy (DOE) from their publication: "Energy Conservation in Existing Buildings", February 1980. The attached table showing thermal losses for storage tanks is developed from the DOE nomograph.

Use of the charts results in heat loss rates for bare tanks and for tanks with various insulation thicknesses. For the purposes of these calculations, it is assumed that 3-inches of insulation is applied.

The attached tabular calculations are performed as follows:

Tank heat loss calculations

Tank Capacity:

Gallons

Existing Temp.:

degrees F

Ins. Thickness:

Existing thickness assumed to be 1-inch equivalent

Replacement insulation to be 3-inch

Heat Loss Rate BTU/Hr (from charts)

Existing Condition:

Rate of heat loss or gain in BTUH for existing tank condition (1-inch thick insulation) determined from DOE nomograph

Proposed Condition:

Rate of heat loss or gain in BTUH for tank with new insulation

(3-inch thick)determined from DOE nomograph

Energy Savings Calculations

Heat Loss:

The annual heat load loss for each condition is determined by multiplying the

heat loss rate per hour by 8,760 hours per year (continuous loss).

Annual Heat Loss Saved:

The annual heat loss load saved is the difference of the heat loss

for the exisiting and proposed conditions.

Energy Savings:

Energy savings are determined by dividing the load savings by the DHW heater

efficiency. For DHW system efficiencies, refer to "EEAP Limited Energy Study,

Fort Hunter Liggett, California", 1993.

ECO C3: INSULATE HOT WATER STORAGE TANKS

Energy Cost Savings

Annual and life cycle energy cost savings are determined as follows:

Annual Energy Cost Savings:

Electricity

kWH/Yr Saved x 0.003413 MBTU/kWH x \$18.23/MBTU = \$/Yr Saved

Propane

MBTU/Yr Saved x \$ 7.87/MBTU = \$/Yr Saved

Fuel Oil

MBTU/Yr Saved x \$ 4.98/MBTU = \$/Yr Saved

Life Cycle Energy Cost Savings for economic life of 15 years:

Electricity

\$/Yr Saved x (15 year UPW: 11.70) = LCC \$ Saved

Propane

\$/Yr Saved x (15 year UPW: 14.16) = LCC \$ Saved

Fuel Oil

\$/Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders:

General Conditions:

8.0%

Estimating Contingency:

10.0%

Contractor's Overhead and Profit:

30.0% -

Bond:

1.0%

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH):

Allowance for Design Services:

Operation and Maintenance Cost Savings

Maintenance costs are expensed at 2.5% of the bare costs of installation p

5.5%

"Savings", entries are negative, or in parentheses.

6.0%

Life cycle maintenance cost savings are determined by multiplying the annual maintenance cost savings by the non-energy UPW factor of 11.12 (15 year economic life).

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO C3 INSULATE HOT WATER STORAGE TANKS

Assumptions:

- 1. Existing Hot Water Heater tanks that do not have insulation blankets are assumed to have the equivalent of 1-inch thick insulation.
- 2. Installation of an insulation jacket will provide the equivalent of 3-inch thick insulation.
- 3. Heat losses are in addition to those included in "Efficiency" calulation under "Convection Losses".
- 4. Unless controlled by time clock or other means, losses are assumed to be continuous, 8,760 Hours per year.

DOMESTIC HOT WATER TANK INSULATION

Building	DHW		Existing Cond	dition	Proposed Co	ndition	Heat Loss
Number	Tank	Existing	Tank Insttn	Heat Loss	Tank Insltn	Heat Loss	Load Saved
	Galions	Temp Deg F	Inches	Mil BTU/Yr	Inches	Mil BTU/Yr	Mil BTU/Yr
80	80	135	1	5.1	3	1.8	3.3
81	20 & 40	135	1	5.2	3	1.9	3.3
101	100	160	1	8.3	3	3.0	5.3
101	40	140	1	3.3	3	1.2	2.1
101	83	140	1	5.6	3	2.0	3.6
120	100	110	1	3.9	3	1.4	2.5
120	100	140	1	6.5	3	2.4	4.1
124	40	160	1	4.2	3	1.5	2.7
127	100	128	1	5.5	3	2.0	3.5
144	69	Not used	1	0.0	3	0.0	0.0
197	6	128	1	1.3	3	0.5	0.8
206	2 x 850	140	1	57.8	3	21.0	36.8
210	100	140	1	6.5	3	2.4	4.1
219	80	120	1	4.0	3	1.5	2.5
238	125	122	1	5.6	3	2.0	3.6
252	52	120	1	2.9	3	1.1	1.8
287	40	140	1	3.3	3	1.2	2.1
290	100	135	1	6.1	3	2.2	3.9

DOMESTIC HOT WATER TANK INSULATION LOSSES:

Insulation Thickness	Tank	BTUH Losses at	Water Tempera	atures					
(k = 0.3)	Gallons	100 Deg F	120 Deg F	122 Deg F	128 Deg F	135 Deg F	140 Deg F	160 Deg F	180 Deg F
	6	519	863	897	1,001	1,121	1,207	1,634	2,060
	20	768	1,277	1,327	1,480	1,658	1,785	2,407	3,028
	40	1,123	1,867	1,941	2,165	2,425	2,611	3,510	4,409
	50	1,301	2,163	2,249	2,507	2,809	3,024	4,062	5,100
	52	1,337	2,222	2,311	2,576	2,886	3,107	4,173	5,238
	69	1,639	2,724	2,833	3,158	3,538	3,809	5,111	6,413
Bare	80	1,834	3,049	3,170	3,534	3,959	4,263	5,718	7,172
	83	1,888	3,138	3,262	3,637	4,075	4,387	5,884	7,380
	100	2,190	3,640	3,784	4,219	4,727	5,089	6,822	8,554
	125	2,465	4,097	4,260	4,749	5,320	5,728	7,682	9,637
	250	3,840	6,382	6,636	7,398	8,288	8,923	11,987	15,051
	500	6,292	10,456	10,872	12,122	13,579	14,620	19,640	24,660
	850	9,725	16,160	16,804	18,735	20,987	22,596	30,354	38,113
	1,700	18,062	30,014	31,209	34,794	38,978	41,966	56,374	70,783
	6	83	129	134	147	164	175	223	270
	20	122	191	198	219	243	260	330	400
	40	178	280	290	320	356	381	483	585
	42	184	289	299	330	367	393	499	604
	50	206	324	335	371	412	441	560	678
	52	212	333	345	381	423	453	575	697
	69	259	408	422	467	519	556	705	854
1-inch Thick	80	290	456	473	522	581	622	789	956
	82	296	465	482	533	592	634	805	975
	100	346	545	564	624	693	743	943	1,142
	125	390	613	635	702	780	836	1,061	1,285
	250	607	955	990	1,094	1,216	1,303	1,653	2,002
	500	994	1,565	1,622	1,793	1,992	2,135	2,708	3,280
	850	1,536	2,418	2,506	2,771	3,079	3,300	4,185	5,069
	1,700	2,852	4,490	4,654	5,146	5,719	6,129	7,772	9,414
	50	109	173	179	198	220	236	299	362
2-inch Thick	100	184	291	301	333	370	397	503	609
	250	323	510	528	584	649	696	883	1,069
	500	528	834	865	956	1,064	1,140	1,446	1,751
	6	29	46	48	53	59	63	81	98
	15	40	63	65	73	81	86	110	133
	20	43	69	71	79	88	94	120	145
	40	64	101	105	116	129	138	175	212
	42	66	104	108	119	133	142	180	218
	50	74	117	121	134	149	160	203	245
	52	76	120	124	138	153	164	208	252
	69	93	148	153	169	188	202	255	308
3-inch Thick	80	105	166	172	190	211	226	286	345
	83	108	171	177	196	217	233	294	355
	100	125	198	205	227	252	270	341	412
	125	141	222	230	255	283	304	384	464
	250	219	346	359	397	441	473	598	722
	500	359	567	588	650	723	775	980	1,184
	850	555	876	909	1,005	1,117	1,198	1,514	1,831
	1,075	681	1,075	1,115	1,233	1,370	1,470	1,857	2,247

Source: Architects and Engineers Guide to Energy Conservation in Existing Buildings, February 1980, U.S. DOE.

ECO-C3 INSULATE HOT WATER STORAGE TANKS

Fac	Existing (Existing Condition	ECO - C3	ECO - C3 Energy Savings	S								
Š	Tank Insttn	Tank Insitn Heat Loss	Tank Insitn	Fuel Oil	Propane	Electric	FO Ann.	Prop. Ann Elec. Ann	Elec. Ann	ည	Bare	Invest-	SIR
	Inches	Mil BTU/Yr	Inches	Mil BTU/Yr	Mil BTU/Y	Mil BTU/Y	Savings	Savings	Savings	Savings	Cost	ment	
P 80	-	5.1	က		٠	3.3	\$	\$0	\$60	\$704	\$75	\$130	5.40
P 81	-	5.2	က	,	٠	3.3	\$0	\$0	09\$	\$704	\$150	\$261	2.70
P 101	-	8.3	ო	•	9.7	•	\$0	09\$	0\$	\$844	\$100	\$174	4.85
	-	3.3	ო	•	3.0	1	\$0	\$24	0\$	\$334	\$75	\$130	2.56
	-	5.6	က	1	5.1		\$0	\$40	0\$	\$572	\$75	\$130	4.39
T 120		3.9	က	ŧ	3.3	•	\$0	\$26	0\$	\$320	\$100	\$174	2.13
	-	6.5	3	•	5.8	•	\$0	\$46	0\$	\$652	\$100	\$174	3.75
T 127	-	5.5	က	1	5.0		\$0	\$39	0\$	\$556	\$100	\$174	3.20
S 197	-	1.3	က	•	-	9.0	\$0	\$0	\$15	\$171	\$75	\$130	1.31
P 206	-	57.8	က	42.4	-	•	\$211	\$0	0\$	\$2,909	\$1,560	\$2,713	1.07
P 210	-	6.5	က	5.9	•		\$29	\$0	\$0	\$402	\$100	\$174	2.31
P 219	-	4.0	က	ŧ	3.3	,	0\$	\$26	0\$	\$367	\$75	\$130	2.81
\$ 238	-	5.6	3	•	4.5	,	0\$	\$35	0\$	005\$	\$100	\$174	2.87
P 252	-	2.9	က	t	1	1.8	. \$0	\$0	\$33	\$384	\$75	\$130	2.94
P 287	-	3.3	3	t	2.9		\$0	\$23	0\$	\$321	\$75	\$130	2.46
S 290	-	6.1	က	1	5.5	-	\$0	\$44	0\$	\$617	\$100	\$174	3.55
			Totals	48.3	46.1	9.5	240	363	168	\$10,407	\$2,935	\$5,105	2.04

CONSTRUCTION COST EST	ГІМАТ	E		Date Prepared Sheet OF June 1993)F
Project				Project No.	Basis for	Estimate	
EEAP Limited Energy Study				1	Code A	(no design com	peted)
Fort Hunter-Liggett, California							
Engineer-Architect							
Keller & Gannon			•				
Drawing No.		Estimato	or		Checked	Ву	
ECO C3 Insulate Hot Water Storage Ta	anks	RJB		Labor	BIH	Aaterial	
Line Item	No.	Unit	Per	T	Per		Total
	Units	Meas.	Unit	Total	Unit	Total	Cost
	<u> </u>			ļ			
< 80 Gal. DHW Heater Insulation Kit	9	Ea	\$48	\$432	\$27	\$243	\$675
fiberglas 1 1/2" thick							
> 80 Gal. DHW Heater	7	Ea	\$65	\$455	\$35	\$245	\$700
850 Gal. Tank Insulated w/3" CaSil	2	Ea	\$455	\$910	\$325	\$650	\$1,560
Subtotal	-						\$2,935
General Conditions @ 8%							\$235
Subtotal							\$3,170
Contractor OH & Profit @ 30%							\$951
Subtotal					i		\$4,121
Bond @ 1%							\$41
Subtotal	-	 	ļ				\$4,162
Estimating Contingency @ 10%	 	 		1			\$416
Total Probable Construction Cost	+						\$4,578
Total Probable Construction Cost							Ψ4,070
	-						
					ļ		
	+	<u> </u>		1			
	1	1					
	1						

ECO C-5 TOTAL

Location: Project Title:	Fort Hunter Ligg	rgy Improvements	Region No. 4	Lawer Heads and Fausat	Project No. Fiscal Year FY95
Discrete Porti		5 Heduce Domestic	Economic Life:	nower Heads and Faucet 15 YEARS	Preparer: KELLER & GANNON
•					
1. Investment			#4.000		
A. Construction	on Costs		\$1,326	_	
B. SIOH			\$73	_	
C. Design Co	st		\$80		
	(1A+1B+1C)		\$1,478		
	alue of Existing Ed	nuipment		\$0	
	ty Company Reba			\$0	_
	stment (1D-1E-1F)				- \$1,478
G. Total inves	surient (10-16-11)				4.1,
0 5	vings (+)/Cost(-):				
Date of NISTI	R 85-3273-X Used	for Discount Factor	s: October 1992	_	
Energy	Cost	Saving	Annual \$	Discount	Discounted
	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
Source	φ/ W (1ΒΟ/(1)	NIBTO, TT(Z)	ouvings(o)		
A. Elec.	\$18.23	32.9	\$599.77	11.70	\$7,017
B. Dist	\$4.98	0.0	\$0.00	13.78	\$ 0
C. Propane	\$7.87	2.1	\$16.86	14.16	\$239
D. Demand	\$108.60	0.0	kW \$0.00	11.70	\$0
E. Other	Ψ100.00				•
F. Total			\$616.63		\$7,256
2 Non Energ	y Savings (+) or	Cost (-):			
3. Non Energ	y Savings (+) or	OOST (-).		_	
A. Annual Re	curring (+/-)		\$0	_	
(1) Discount	Factor (Table A)			11.12	
	ed Savings/Cost (3A x 3A1)			\$0
B. Non Recu	rring Savings (+)	or Cost (-)			
		Year of	Discount	Discounted Sav-	
ltem	Savings(+)				
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a .					
b.		_			
C.			3		:
d. Total					
C Total Non	Energy Discounte	d Savings (3A2+3Bo	14)	\$0	
4. Simple Par	vback 1G/(2F3+3	A+(3Bd1/Economic	Life)):	2.4	Years
	Discounted Saving			\$7,256	
	Investment Ratio			4.91	
	nternal Rate of Re			15.64%	
7. Aujustea II	illeriiai nale oi ne	contraction (contract).		10.0170	

ECO C-5 PART A

Location: Project Title:	Fort Hunter Ligg	rgy Improvements	Region No			Project No. Fiscal Year FY95	
Discrete Portion Analysis Date		-5 PART A Install Se	Economic	Life: 1	5 YEARS	Preparer: KELLER & GANNO	NC
1. Investment A. Construction B. SIOH	on Costs		\$1,12 \$62 \$67	?			
E. Salvage Va F. Public Utilit	st (1A+1B+1C) alue of Existing Ed ty Company Reba stment (1D-1E-1F)	ite	\$1,25		\$0 \$0	 \$1,252	
2. Energy Sav	vings (+)/Cost(-): R 85-3273-X Used	I for Discount Factors	: October 199	2			
Energy Source	Cost \$/MTBU/(1)	Saving MBTU/YR(2)	Annual \$ Savings(3)	Discount Factor(4)	Discounted Savings(5)	
A. Elec. B. Dist C. Propane D. Demand E. Other F. Total	\$18.23 \$4.98 \$7.87 \$108.60	20.1	\$366. \$0.0 \$0.0 kW \$0.0	0 0 0	11.70 13.78 14.16 11.70	\$4,287 \$0 \$0 \$0 \$0 \$0	
3. Non Energ	y Savings (+) or	Cost (-):		<u></u>			
(2) Discounte	curring (+/-) Factor (Table A) d Savings/Cost (3		\$0		11.12	 \$0	
item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)		Discounted Sa ings(+)Cost(-)		
a. b. c. d. Total				-			
C Total Non E	Energy Discounte	d Savings (3A2+3Bd	4)		\$0		
5. Total Net D 6. Savings to	/back 1G/(2F3+3 Discounted Saving Investment Ratio Internal Rate of Re	(SIR) 5/1G:	Life)):		3. \$4,28 3.4 12.89	7 2	

ECO C-5 PART B

Location: Project Title: I	Fort Hunter Ligge		Region No. 4			Project No. Fiscal Year FY95
Analysis Date		PART D INStall Flow	Economic Life:	15	YEARS	Preparer: KELLER & GANNON
1. Investment	Costs					
A. Construction			\$203	-		
B. SIOH			\$11	-		
C. Design Co	st		\$12	_		
D. Total Cost	(1A+1B+1C)		\$226	_		
	llue of Existing Equ				\$0	_
	y Company Rebate	9			\$0	_ \$226
G. Total Inves	tment (1D-1E-1F)					\$220
2. Energy Sav	vings (+)/Cost(-):	for Discount Factors: (Octobor 1002	-		
Date of NISTI	R 85-3273-X Used 1	for Discount Factors: (Jolober 1992			
Energy	Cost	Saving	Annual \$		Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)		Factor(4)	Savings(5)
004.00	4 /==/(./					
A. Elec.	\$18.23	12.8	\$233.34		11.70	\$2,730
B. Dist	\$4.98	-	\$0.00		13.78	\$0
C. Propane	\$7.87	2.1	\$16.86		14.16	\$239
D. Demand	\$108.60	kW	\$0.00		11.70	\$0
E. Other				=		
F. Total			\$250.21			\$2,969
3. Non Energ	y Savings (+) or C	ost (-):		_		
			40			
A. Annual Red			\$0	_	11 10	
	actor (Table A)	0.4.1)			11.12	\$0
(2) Discounte	d Savings/Cost (3A	AX SAI)				40
B. Non Recur	ring Savings (+) o	r Cost (-)				
	0	Vanuat	Discount		Discounted Sav-	
Item	Savings(+)	Year of Occur. (2)	Factor(3)		ings(+)Cost(-)(4)	
	Cost(-)(1)	Occur. (2)	1 40.01(0)		1195(1)0051()(1)	
a.						
b.			-			
C.				=		•
d. Total						
C Total Non E	Energy Discounted	Savings (3A2+3Bd4)			\$0	
4 Simple Par	/back 1G//2F3±3A	+(3Bd1/Economic Life))):		0.9	Years
	iscounted Savings		<i>//-</i>		\$2,969	
	Investment Ratio (13.13	
	nternal Rate of Retu				23.48%	

ECO C5: REDUCE DOMESTIC HOT WATER FLOW AT SHOWER HEADS AND FAUCETS

This ECO evaluates the reduction of hot water usage by the installation of metering or sensor operated lavatory faucets and/or low flow faucets and shower heads.

Energy savings are achieved by reducing domestic hot water (DHW) consumption.

This ECO is divided into two parts:

Part A Installation of Self-Metering faucets

Part B Installation of flow restricting shower heads and lavatory aspirators

Part A

Hot water consumption can be reduced because self metering faucets prevent faucets from being left open, running continuously and wasting hot water.

Metering faucets allow water flow for only a few seconds, then the valve closes until the lever is depressed again.

Sensor operated lavatory faucets only permit water flow if a sensor perceives a person's hands inside the lavatory bowl.

Although catalog literature claims installation of said valves would reduce water consumption by 80%, it was more conservatively assumed to result in a 50% reduction in water consumption.

Thus the water savings was found by:

(# of people) x (4 hand washes per day) x (1 minute per hand wash) x 3 GPM x 50% = (# of people) x (6 gallons per day)

Part B

Domestic hot water usage can also be reduced by the installation of flow restricting shower heads and lavatory faucets. Load reductions from existing shower heads and lavatory faucets are provided with Part B calculations.

Energy Savings Calculations

Based on hot water supply temperature and gallons saved per day the energy savings were determined for both self-metering devices and flow restrictors (refer to EEAP Limited Energy Study for Fort Hunter Liggett, dated 1993). Load reductions are divided by the DHW heating system efficiency to calculate energy savings.

Annual and life cycle energy cost savings are determined as follows:

Annual Energy Cost Savings:

Electricity kWH/Yr Saved x 0.003413 MBTU/kWH x \$18.23/MBTU = \$/Yr Saved

Propane MBTU/Yr Saved x \$ 7.87/MBTU = \$/Yr Saved Fuel Oil MBTU/Yr Saved x \$ 4.98/MBTU = \$/Yr Saved

ECO C5: REDUCE DOMESTIC HOT WATER FLOW AT SHOWER HEADS AND FAUCETS

Life Cycle Energy Cost Savings for economic life of 15 years:

Fuel Oil \$/Yr Saved x (15 year UPW: 11.70) = LCC \$ Saved \$/Yr Saved x (15 year UPW: 14.16) = LCC \$ Saved \$/Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders:

General Conditions: 8.0% - 10.0% Estimating Contingency: 10.0% Contractor's Overhead and Profit: 30.0% Bond: 1.0%

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH): 5.5%
Allowance for Design Services: 6.0%

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO C5 INSTALL FLOW RESTRICTORS

FLOW RESTRICTING SHOWER HEAD AND LAVATORY FAUCET RETROFIT

Non Lo-Flow Devices: Lo-Flow Devices:

Shower Heads 5.00 gpm 2.00 gpm Faucets 3.00 gpm 0.75 gpm

Function Code 1: Offices 2.00 GPCD

Assume use from faucets 75% and by Janitor 25%.

Usage with Lo-Flow faucet aspirators: 1.10 GPCD

Function Code 2: Shops & Warehouses 5.00 GPCD

Assume use from faucets 50% of total usage.

Usage with Lo-Flow faucet aspirators: 3.50 GPCD

Function Code 2.1: Commercial Laundries - Not Applicable to this ECO.

Function Code 3: Barracks & Quarters w/o Dining 30.00 GPCD

		Lo-Flow
Usage	GPCD	GPCD
Showers	19.50	7.80
Faucets	4.50	1.13
Clothes Washir	ng 6.00	6.00
Total	30.00	14.93

Function Code 3.1: Detatched Latrine with Bathing 25.00 GPCD

Usage	GPCD	Lo-Flow GPCD
Showers	19.50	7.80
Faucets	4.50	1.13
Clothes Washing	0.00	0.00
Total	24.00	8.93

Function Code 4: Barracks & Quarters with Dining 30.00 GPCD

Same as Function Code 3 for non-cooking hot water usage:

14.93 GPCD

Function Code 5: Recreation & Gyms w/o Bathing 0.50 GPCD

Assume use from faucets 50% of total usage.

Usage with Lo-Flow faucet aspirators: 0.35 GPCD

Function Code 5.1: Recreation & Gyms with Bathing 12.00 GPCD

	Lo-Flow
GPCD	GPCD
10.50	4.20
1.50	0.38
0.00	0.00
12.00	4.58
	10.50 1.50 0.00

ECO C5 INSTALL FLOW RESTRICTORS

Function Code 6: Theaters & Sin	nilar Commu	ınity Facilities		0.50
Assume use from fauc Usage with Lo-Flow fa			0.35	GPCD
Function Code 7: Dining Facilitie	s, all uses			0.25
Assume use from fauc Usage with Lo-Flow fa		_	0.18	GPCD
Function Code 8: Base Exchange	es & Stores		0.50	GPCD
Assume use from fauc Usage with Lo-Flow fa		_	0.35	GPCD
Function Code 8.1: Commissarie	es		0.50	GPCD
Assume use from fauc Usage with Lo-Flow fa			0.35	GPCD
Function Code 9: Clubs - Officer		2.00		
Assume use from fauc Usage with Lo-Flow fa				GPCD
Function Code 10: Family Housi	ng		40.00	GPCD
Usage Showers Faucets Clothes Washing Total	GPCD 27.00 8.00 5.00 40.00	Lo-Flow GPCD 10.80 2.00 5.00 17.80		
Function Code 11.1: Schools wit	thout Bathin	g	5.00	GPCD
Usage Other Uses Faucets Total	GPCD 0.50 4.50 5.00	Lo-Flow GPCD 0.50 1.13 1.63		
Function Code 11.2: Schools wit	th Bathing		11.00	GPCD
Usage Showers Faucets Total	GPCD 6.50 4.50 11.00	Lo-Flow GPCD 2.60 1.13 3.73		

ECO C5 INSTALL FLOW RESTRICTORS

Function Code 11.3: Child Development Centers

8.00 GPCD

		Lo-Flow
Usage	GPCD	GPCD
Showers	0.00	0.00
Faucets	8.00	2.00
Total	8.00	2.00

Function Code 12: Medical Facilities, Clinics

20.00 GPCD

No modifications are proposed for medical facilities.

Function Code 12.1: Medical Facilities, Hospitals

120.00 GPCD

No modifications are proposed for medical facilities.

Function Code 13: Buildings with More than One Use

Each type of use is considered separately.

ECO C5 PART A: INSTALLATION OF SELF-METERING FAUCETS

				7	
	SIR		4.14		4.14
	lnvest-	ment	\$1,252		\$1,252
	Bare	Cost	\$720		\$720
П	၁၁၂	Savings	\$5,189		\$5,189
	Prop. An	Saving	-	£	•
	FO Ann.	Saving	•	•	,
	Elect. Ann FO Ann. Prop. An	Savings	\$366		\$366
S	Propane	BTU/Yr Mil BTU/Y Mil BTU/Y Savings	•		•
ergy Saving	Fuel Oil	Mil BTU/Y	•		
ECO C5 Energy	Electric	Mil BTU/Yr	20.1		20.1
	Capacity	Mil BTUH	1.875		
ing System	System	Temp.	132		
DHW Heat	Fuel	Used	Electric		
Fac	Š.		301		

ECO-C5 PART B: INSTALLATION OF FLOW RESTRICTING SHOWER HEADS AND LAVATORY FAUCETS

Analysis of the Effect of Installation of Flow Restricting Faucets/Shower Heads on Domestic Hot Water Energy Savings

Bldg.	DHW Heal	Heating System	m	ECO CS EI	ECO C5 Energy Savings								
Š	Fuel	System	Capacity	Electric	Fuel Oil	Propane	Propane Elect. Ann Fuel Oil Prop. Ann	Fuel Oil	Prop. Ann	ည	Bare	nvest-	SIR
	Osed	Temp.	ВТОН	Mil BTU/Y	BTU/Y Mil BTU/Yr	Mil BTU/Y	Mil BTU/Y \$ Savings \$ Savings \$ Savings	\$ Savings	\$ Savings	Savings	Cost	ment	
127	Propane	110	240,000			2.1	-	•	\$17	\$239	\$90	\$157	1.53
197	Electric	125	1.25 kW	12.8	,	,	\$233		_	\$2,730	\$40	\$20	39.24
				12.8		2.1	\$233	•	\$17	\$2,969	\$130	\$226	\$226 13.13

			•	Date Prepare		Sheet	OF
CONSTRUCTION COST	ESTI	MATE		June 19	93		
Project				Project No.	Basis for E	stimate	
EEAP Limited Energy Study					Code A (no design comp	ated)
Location					Code A (i	no design comp	eteu)
Fort Hunter-Liggett, California					1		
Keller & Gannon							
Drawing No.		Estimat	or		Checked B	у	
ECO-C5 Install Self-Metering Fauce	ets	RJB uantity		abor	BIH	aterial	
Line Item	No.	Unit	Per		Per		Total
	Units	-	Unit	Total	Unit	Total	Cost
Self-Metering Lav. Faucets	3	EA	\$40	\$120	\$200	\$600	\$720
	-						
Subtotal	-						\$720
General Conditions @ 8%	†						\$58
Subtotal					 		\$778
Contractor OH & Profit @ 30%							\$233
Subtotal	+						\$1,011
Bond @ 1%							\$10
Subtotal	1						\$1,021
Estimating Contingency @ 10%	<u> </u>				† · · · · · · · ·		\$102
Total Probable Construction Cost							\$1,123
			-				
					}		
			•				
			_				

				Date Prepare	ed	Sheet	OF
CONSTRUCTION COST E	STII	MAT	Ξ	June 19	993		
Project				Project No.	Basis for E	stimate	
EEAP Limited Energy Study							
Location					Code A (no design comp	eted)
Fort Hunter-Liggett, California					-		
Engineer-Architect Keller & Gannon							
Drawing No.		Estima	tor		Checked E	Ву	
ECO-C5 Install flow restrictors	•	RJB			BIH		
1 in a Mann	No.	uantity Unit	Per	Labor	M Per	aterial	Total
Line Item		Meas.	Unit	Total	Unit	Total	Cost
Bldg 127 Shower Flow Restrictors	3	LS	\$10	\$30	\$20	\$60	\$90
Bldg 197 Lavatory Flow Restrictors	2	LS	\$15	\$30	\$5	\$10	\$40
Subtotal							\$130
General Conditions @ 8%							\$10
Subtotal							\$140
Contractor OH & Profit @ 30%							\$42
Subtotal							\$183
Bond @ 1%							\$2
Bond @ 1% Subtotal Estimating Contingency @ 10% Total Probable Construction Cost							\$184
							\$18
							\$203
	ĺ						
	1						
	†						

ECO C8

Location: Project Title	Fort Hunter Lig	ergy Improvements	Region No. 4		Project No. Fiscal Year FY95
		08 Dishwasher Heat R			
Analysis Da	ate: June 1993		Economic Life:	15 YEARS	Preparer: KELLER & GANNOR
1. Investme					
A. Construc	ction Costs		\$5,839		
B. SIOH			\$321		
C. Design (\$350		
	st (1A+1B+1C)	·	\$6,510	\$0	
	Value of Existing E			\$0	
	tility Company Reb restment (1D-1E-1F				 \$6,510
G. Total in	Vestment (10-12-17	,			40,010
2. Eneray S	Savings (+)/Cost(-)				
Date of NIS	TIR 85-3273-X Use	d for Discount Factor	October 1992		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
				11.70	ΦO.
A. Elec.	\$21.84	0.0 339.0	\$0 \$1,688	11.70 13.78	\$0 \$23,263
B. Dist	\$4.98 \$7.87	0.0	\$0	14.16	\$0
C. Propane D. Demand			kW \$0	11.70	\$0
E. Other	\$100.00				
F. Total			\$1,688		\$23,263
3. Non Ene	ergy Savings (+) or	Cost (-):			
A Annual F	Recurring (+/-)		(\$160)		
	nt Factor (Table A)		(,,,,,	11.12	
· ,	nted Savings/Cost ((3A x 3A1)			(\$1,779)
B Non Bed	curring Savings (+)	or Cost (-)			
			Diagonat	Discounted (2au
Item	Savings(+)	Year of	Discount	Discounted (ings(+)Cost	
	Cost(-)(1)	Occur. (2)	Factor(3)	nigs(+)cost	(-)(4)
a.					
b.			-		
c.					
d. Total					
C Total No	n Energy Discounte	ed Savings (3A2+3Bd	4)	(\$1,779)	
4 Simple F	Payback 1G/(2F3+3	BA+(3Bd1/Economic L	_ife)):		4.3 Years
	t Discounted Savin		*	\$21,	
	to Investment Ratio			*	3.30
	Internal Rate of Re				62%

ECO C8: DISHWASHER HEAT RECOVERY

Install a commercial type package heat recovery unit at each dishwashing location in facility 206. The unit extracts waste heat from dishwasher discharge and it uses it to preheat cold water make-up.

The Waste Energy Transfer System, Molitor Industries, Inc. recycles 70% to 75% of water normally wasted.

Energy Saving Calculations

Refer to attached brochure for supporting data. DHW to dishwashers is provided at 140 deg F from building system, fuel oil fired, average thermal efficiency 70.8%.

Of the total baseline DHW heating fuel use of 906 Mil BTU/yr in building 206, 50% is assumed used in the dishwasher. Dishwashers heat DHW from the DHW supply temperature to about 180 deg F for sanitizing; discharge temperature from the dishwasher is 180 deg F.

75% heat recovery is possible:

906 Mil. BTU/yr x $0.5 \times 0.708 = 321$ Mil. BTU/yr thermal load for dishwashing.

75% recovery = 321 Mil. BTU/yr x 0.75 = 240 Mil. BTU/yr recovery

Recovered heat is sent to the DHW makeup. Avoided use of fuel oil is:

(240 Mil. BTU/yr / 0.708) = 339 Mil. BTU/yr fuel oil saved

\$4.98 x 339 Mil. BTU/yr = \$1688/year saved

Annual Energy Cost Savings:

Fuel Oil

MBTU/Yr Saved x $4.98/MBTU = \frac{y}{r}$ Saved

Life Cycle Energy Cost Savings for economic life of 15 years:

Fuel Oil

 $\/\$ Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Operations and Maintenance (O&M) Costs

Allow 4 hrs/yr at \$40/hr for maintenance, cleaning, etc. = \$160/yr

Life cycle maintenance cost savings are determined by multiplying the annual maintenance cost savings by the non-energy UPW factor of 11.12 (15 year economic life).

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders:

General Conditions:

8.0%

Estimating Contingency:

10.0%

ECO C8: DISHWASHER HEAT RECOVERY

Contractor's Overhead and Profit:

30.0%

Bond:

1.0%

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH):

5.5%

Allowance for Design Services:

6.0%

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

				Date Prepared		Sheet (OF
CONSTRUCTION COST ES	TIMAT	Έ		June 1993	3		
Project				Project No.	Basis for Est	imate	
EEAP Limited Energy Study							
Location					Code A (no	design competed)
Fort Hunter-Liggett, California					_		
Engineer-Architect							
Keller & Gannon Drawing No.		Estimato	r		Checked By		
ECO-C8 Dishwasher Heat Recovery		RJB			ВІН		
ECO-Co Distiwastier Fleat Recevery	Qu	antity	La	bor	Mate	erial	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
Building 206							
Molitor or Equal Unit	1	Ea	\$352	\$352	\$1,217	\$1,217	\$1,569
Drain Piping 2-inch Galv	20	LF	\$8.99	\$180	\$6.78	\$136	\$315
Water Piping 1-inch CU	130	LF	\$6.14	\$798	\$3.52	\$457	\$1,256
Pipe Insulation 1-inch @ pipe	130	LF	\$2.52	\$328	\$1.47	\$191	\$519
Wiring	-	Job	\$100	\$100	\$50	\$50	\$150

Subtotal Building 206				<u> </u>			\$3,808
General Conditions 8%					ļ	ļ <u> </u>	\$305
Contractor O.H. & P 30%	_						\$1,142
Sub Total							\$5,255
Bond 1%							\$53
Sub Total							\$5,308
Estimating Contingency 10%							\$531
Total Probable Construction Cost							\$5,839
			Walter				

ECO C-9

		gett, California ergy Improvements C9 Install Automatic	Region No. 4		Project No. Fiscal Year FY95
	e: June 1993	OF Install Automatic	Economic Life:		Preparer: KELLER & GANNON
1. Investmen	t Costs				
A. Constructi	on Costs		\$1,712		
B. SIOH			\$94		
C. Design Co			\$103	_	
	(1A+1B+1C)		\$1,909		
_	alue of Existing E			\$0	
	ty Company Reb			\$0	
G. Total Inves	stment (1D-1E-1F)			\$1,909
2. Energy Sa	vings (+)/Cost(-):				
Date of NIST	R 85-3273-X Use	d for Discount Factor	October 1992		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$21.84	0.0	\$0	11.70	\$0
B. Dist	\$4.98	51.0	\$254	13.78	\$3,500
C. Propane	\$7.87	31.0	\$244	14.16	_ \$3,455
D. Demand	\$108.60	0.0	kW \$0	11.70	\$0
E. Other			**		_
F. Total			\$498		\$6,954
3. Non Energ	y Savings (+) or	Cost (-):			
A. Annuai Re			\$0		
• •	Factor (Table A)			11.12	_
(2) Discounte	d Savings/Cost (3A x 3A1)			\$0
B. Non Recur	ring Savings (+)	or Cost (-)			
Item	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4	
a.					_
b.			-		
C.					=
d. Total					
C Total Non E	Energy Discounte	d Savings (3A2+3Bd	4)	\$0	
4. Simple Pay	back 1G/(2F3+3	A+(3Bd1/Economic l	_ife)):	3.8	Years
	iscounted Saving		,,	\$6,954	
	Investment Ratio			3.64	
_	ternal Rate of Re			13.36%	

ECO C9: INSTALL AUTOMATIC FLUE DAMPERS ON DHW SYSTEMS

This measure is developed to evaluate the potential energy savings created by the installation of an automatic damper which closes off the flue whenever the burner has completed a firing cycle.

During normal operations, about 2% to 3% of boiler fuel use is lost through the flue between burner firing cycles.

Energy Savings Calculations

Energy savings are achieved by raising the boiler/heater efficiency by about 1.5%. Fuel savings are determined based on baseline fuel use and existing boiler efficiencies. Baseline energy use and system efficiency determinations are provided in: "EEAP Limited Energy Study for Fort Hunter Liggett", dated 1993. Savings are calculated as follows:

Qs = Qo - Qo x Efficiency / (Efficiency + 1.5%)

where:

Qs = Fuel Savings

Qo = Baseline fuel use (after reduction of domestic hot water

temperatures to authorized levels)

Efficiency = Baseline system efficiency

Annual energy cost savings are based on fuel savings calculations as explained above:

Propane

MBTU/Yr Saved x \$ 7.87/MBTU = \$/Yr Saved

Fuel Oil

MBTU/Yr Saved x \$ 4.98/MBTU = \$/Yr Saved

Life Cycle Energy Cost Savings for economic life of 15 years:

Propane

\$/Yr Saved x (15 year UPW: 14.16) = LCC \$ Saved

Fuel Oil

\$/Yr Saved x (15 year UPW: 13.78) = LCC \$ Saved

Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders to bare costs:

General Conditions:

8.0%

Estimating Contingency:
Contractor's Overhead and Profit:

10.0%

Bond:

30.0% 1.0% -

Investment is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH):

5.5%

Allowance for Design Services:

6.0%

Economic Analysis

Total Life Cycle Cost (LCC) Savings: Sum of energy and O&M LCC costs savings.

Simple Payback Period: Investment divided by the sum of annual energy and O&M cost savings.

Savings to Investment Ratio (SIR): Total LCC cost savings divided by the investment.

ECO C9 INSTALL AUTOMATIC FLUE DAMPERS ON DHW SYSTEMS

Fac		ECO	ECO ECO C9 Energy	ergy Savings: A	: Automatic	Automatic Flue Dampers	pers					
Š.	Installation Name	6-O	Fuel Oil	Propane	Electric	FO Ann.	Prop. Ann.	Prop. Ann. Elec. Ann.	သဘ	Constr	Invest-	SIR
		Incl.	Mil BTU/Yr	Mil BTU/Yr	MW-Hr/Yr \$ Savings \$ Savings	\$ Savings	\$ Savings	\$ Savings	Savings	Cost	ment	
P 101	Open Din Cons (Haclenda)	Yes	-	2.59	-	0\$	\$20	0\$	\$289	\$568	\$633	0.46
P 128	Officers Quarters Military	SaY	-	15.78	ı	\$0	\$124	0\$	\$1,759	\$568	\$633	2.78
P 210	Hith/Dntl Clinic w/ Beds	Yes	51.02	•	1	\$254	0\$	\$0	\$3,501	\$576	\$642	5.45
\$ 238	Sig Photo Lab	Yes	•	0.95	1	0\$	2\$	\$0	\$106	\$541	\$603	1.72
	Process	Yes	1	8.34	•	\$0	\$66	\$0	\$929			
P 295	Enl Barracks w/o Dining	Yes	1	15.21	•	\$0	\$120	0\$	\$1,695	\$268	\$633	2.68
Totals			51.0	31.0	0.0	\$254	\$244	0\$	\$6,955	\$1,712	\$1,909	3.64

CONSTRUCTION COST ES	TAMITE	Έ		Date Prepared Sheet OF June 1993 Project No. Basis for Estimate			
Project EEAP Limited Energy Study				Project No.	Basis for	Estimate	
Location Energy Study				<u> </u>	Code A	(no design compe	eted)
Fort Hunter-Liggett, California					-	, (as assign compe	,
Keller & Gannon							
Drawing No.		Estimato	or	•	Checked	Ву	
ECO-C9 Install Automatic Flue Damp	ers		RJB			BIH	
Line Item	Qu.	antity Unit	Per La	abor	Per	Material	
Line item	Units	Meas.	Unit	Total	Unit	Total	Total Cost
OIL FIRED HEATERS							
4-inch Diameter Auto-Damper	1	Ea	32.00	\$32	\$156	\$156	\$188
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 4-inch Flue, Oil Fired							\$368
General Conditions 8%							\$29
Contractor O.H. & P 30%							\$29
Sub Total							\$426
Bond 1%							\$4
Sub Total							\$431
Estimating Contingency 10%							\$43
Total Probable Construction Cost							\$474
							V 1,7 1
6-inch Diameter Auto-Damper	1	Ea	34.90	\$35	\$161	\$161	\$196
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 6-inch Flue, Oil Fired							\$376
General Conditions 8%							\$30
Contractor O.H. & P 30%							\$113
Sub Total							\$519
Bond 1%							\$5
Sub Total							\$524
Estimating Contingency 10%							\$52
Total Probable Construction Cost							\$576
8-inch Diameter Auto-Damper	1	Ea	38.40	\$38	\$161	\$161	\$199
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 8-inch Flue, Oil Fired							\$379
General Conditions 8%							\$30
Contractor O.H. & P 30%							\$114
Sub Total							\$524
Bond 1%							\$5
Sub Total							\$529
Estimating Contingency 10%							\$53
Total Probable Construction Cost							\$582

CONSTRUCTION COST ES	STIMAT	Ε		Date Prepared June 1993	3	Sheet (OF .
Project				Project No.	Basis for	Estimate	
EEAP Limited Energy Study							
Fort Hunter-Liggett, California					Code A	(no design compe	eted)
Engineer-Architect					1		
Keller & Gannon							
Drawing No.		Estimato			Checked	•	
ECO-C9 Install Automatic Flue Damp		antity	RJB	abor		BIH Material	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost
GAS FIRED HEATERS							
4-inch Diameter Auto-Damper	1	Ea	32.00	\$32	\$134	\$134	\$166
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 4-inch Flue, Gas Fired							\$346
General Conditions 8%							\$28
Contractor O.H. & P 30%							\$104
Sub Total							\$478
Bond 1%							\$5
Sub Total							\$483
Estimating Contingency 10%							\$48
Total Probable Construction Cost							\$531
6-inch Diameter Auto-Damper	1	Ea	34.90	\$35	\$138	\$138	\$173
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 6-inch Flue, Gas Fired							\$353
General Conditions 8%							\$28
Contractor O.H. & P 30%							\$106
Sub Total							\$487
Bond 1%							\$5
Sub Total							\$492
Estimating Contingency 10%							\$49
Total Probable Construction Cost							\$541
8-inch Diameter Auto-Damper	1	Ea	38.40	\$38	\$152	\$152	\$190
Relay & Wiring	-	Job	-	\$120	-	\$60	\$180
Subtotal 8-inch Flue, Gas Fired				,		1	\$370
General Conditions 8%							\$30
Contractor O.H. & P 30%							\$111
Sub Total							\$511
Bond 1%					<u> </u>		\$5
Sub Total							\$516
Estimating Contingency 10%							\$52
Total Probable Construction Cost							\$568

ECO D4 TOTAL

Location: Project Title:		iggett, California nergy Improvemen	Region No. 4		Project No. Fiscal Year FY95
Discrete Portion		ce Incandescent Li			
Analysis Date:	-		Economic Life:		Preparer: KELLER & GANNON
,,					•
1. Investment C	Costs				
A. Construction	Costs		\$37,630		
B. SIOH			\$2,070		
C. Design Cost	:		\$2,258		
D. Total Cost (1	IA+1B+1C)		\$41,957		
E. Salvage Valu	ue of Existing E	quipment		\$0	
	Company Reba			(\$4,645)	<u> </u>
G. Total Investr	ment (1D-1E-1F))			\$37,312
	(.) (0+()				
2. Energy Savir	ngs (+)/Cost(-):	d for Discount Fact	ore: October 1992		
Date of NISTIR	05-32/3-X USE	u for Discourt Fact	ors. October 1992		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
Cource	Φ/14/12/0/(1)	11107 111(2)			5 a g a (a)
A. Elec.	\$21.84	159.8	\$3,491	11.70	\$40,839
B. Dist	\$4.98	0.0	\$0	13.78	\$0
C. Propane	\$7.87	0.0	\$0	14.16	\$0
D. Demand	\$108.60	22.5 kV	V \$2,439	11.70	\$28,542
E. Other					
F. Total			\$5,930		\$69,381
3 Non Energy	Savings (+) or	Cost (-):			
o. Hon Energy		().	···		
A. Annual Recu	urring (+/-)		\$1,671		
(1) Discount Fa	ctor (Table A)			11.12	
(2) Discounted	Savings/Cost (3A x 3A1)			\$18,578
B. Non Recurri	ng Savings (+)	or Cost (-)			
lt a ma	Savings(+)	Year of	Discount	Discounted Sa	N/-
Item	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)	
	Cost(-)(1)	Occur. (2)	r actor(5)	iligs(+)cost(-)	(4)
a.					
b.					
C.		-	-		
d. Total					
C Total Non Er	nergy Discounte	ed Savings (3A2+3I	3d4)	\$18,578	
4. Simple Payh	ack 1G/(2F3+3	A+(3Bd1/Econom	ic Life)):	4.9	Years
	scounted Saving	•	//-	\$87,960	
	nvestment Ratio			2.36	
	ernal Rate of Re			10 12%	

ECO D4 Part A

Location: Project Title:		ggett, California nergy Improvem		Region No. 4	•	ect No. al Year FY95
Discrete Portion	Name: Replac	ce incandescent	Lial	ntina with Fluoresc	ent, Part A - 60W to 1	3W/5T4
Analysis Date:		50 11154114555		Economic Life: 1	5 YEARS Pres	parer: KELLER & GANNON
Allaysis Date.	ourie 1000					
1. Investment C	osts					
A. Construction				\$21,175		
B. SIOH				\$1,165		
C. Design Cost				\$1,270		
D. Total Cost (1				\$23,610		
E. Salvage Valu	,	guipment		,	\$0	
F. Public Utility	_				(\$2,715)	_
G. Total Investr						\$20,895
	` ′					
2. Energy Savir	ngs (+)/Cost(-):					
Date of NISTIR	85-3273-X Used	d for Discount Fa	acto	rs: October 1992		
Energy	Cost	Saving		Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)		Savings(3)	Factor(4)	Savings(5)
						A
A. Elec.	\$21.84	77.2		\$1,686	11.70	\$19,729
B. Dist	\$4.98	0.0		\$0	13.78	\$0
C. Propane	\$7.87	0.0		\$0	14.16	\$0
D. Demand	\$108.60	7.8	kW	\$845	11.70	\$9,889
E. Other				40.500		400.010
F. Total				\$2,532		\$29,619
- 11 -	0	04/)				
3. Non Energy	Savings (+) or	Cost (-):				
A Appual Book	urring (+/)			\$894		
A. Annual Recu (1) Discount Fa				ΨΟΟ-Τ	11.12	
	Savings/Cost (2A v 2A1)			11.12	\$9,945
(2) Discourited	Savings/Cost (SA X SA 1)				40,010
B Non Becurri	ng Savings (+)	or Cost (-)				
B. Non Recuin	ing cavings (1)	0, 003()				
Item	Savings(+)	Year of		Discount	Discounted Sav-	
item	Cost(-)(1)	Occur. (2)		Factor(3)	ings(+)Cost(-)(4)	
	000.()(1)	0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		(-)		
a.						
b.				. •	•	
C.				*		
d. Total						
G. 10tm.						
C Total Non En	erav Discounte	d Savings (3A2-	+3B	d4)	\$9,945	
	3,	• •		•		
4. Simple Payb	ack 1G/(2F3+3	A+(3Bd1/Econd	omic	: Life)):	6.1	Years
	counted Saving				\$39,564	
	vestment Ratio				1.89	
7 Adjusted Inte					8.52%	

ECO D4 Part B

Location:		iggett, California nergy Improvemer	Region No. 4		oject No. scal Year FY95	
Project Title:	- Nome: Books	nergy improvemer	ighting with Fluoresc			
Analysis Date:		ce incandescent L	Economic Life:		eparer: KELLER & GANN	NON
Analysis Date:	June 1993		Economic Line.	15 TEARS	cparci: REELETT & GATT	1011
1. Investment C	Costs					
A. Construction			\$234			
B. SIOH			\$13			
C. Design Cost			\$14			
D. Total Cost (1A+1B+1C)		\$261			
•	ue of Existing E			\$0		
	Company Reba			(\$30)		
G. Total Investi	ment (1D-1E-1F))			\$231	
2. Energy Savi	ngs (+)/Cost(-):					
Date of NISTIR	85-3273-X Used	d for Discount Fac	tors: October 1992			
	_			· D:	Discounted	
Energy	Cost	Saving	Annual \$	Discount	Discounted	
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)	
A. Elec.	\$21.84	0.7	\$16	11.70	\$181	
B. Dist	\$4.98	0.0	\$0	13.78	\$0	
C. Propane	\$7.87	0.0	\$0	14.16	\$0	
D. Demand	\$108.60	0.1 k		11.70	\$127	
E. Other						
F. Total			\$26		\$308	
O Non-Engrave	Savings (1) or	Cost (.):				
3. Non Energy	Savings (+) or	Cost (5).				
A. Annual Recu	urring (+/-)		\$11			
(1) Discount Fa				11.12		
	Savings/Cost (3A x 3A1)			\$125	
B. Non Recurri	ng Savings (+)	or Cost (-)				
Item	Savings(+)	Year of	Discount	Discounted Sav-		
item	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4		
	0001()(1)	3333 (2)	. 2010. (0)		,	
a.						
b.						
C.						
d. Total						
C Total Non Er	nergy Discounte	ed Savings (3A2+3	BBd4)	\$125		
				• •		
		BA+(3Bd1/Econon	nic Life)):	6.1	Years	
	scounted Saving			\$433		
	nvestment Ratio			1.88		
/ Adjusted Int	ernal Rate of Re	eturn (AINH):		8.46%		

ECO D4 Part C

Location:		ggett, California		Region No. 4		ject No.
Project Title:		nergy Improveme				cal Year FY95
		ce incandescent i	Ligh		ent, Part C - 100W to	
Analysis Date:	June 1993			Economic Life: 15	5 YEARS Pre	parer: KELLER & GANNON
1. Investment (Costs					
A. Construction				\$2,808		
B. SIOH			•	\$154		
C. Design Cos	t		•	\$168		
D. Total Cost (\$3,131		
	ue of Existing E	quipment			\$0	
	Company Reb				(\$360)	
	ment (1D-1E-1F					\$2,771
2. Energy Savi	ngs (+)/Cost(-):					
Date of NISTIF	85-3273-X Use	d for Discount Fa	ctor	rs: October 1992		
Energy	Cost	Saving		Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)		Savings(3)	Factor(4)	Savings(5)
	4,	, , , ,				
A. Elec.	\$21.84	16.1		\$352	11.70	\$4,121
B. Dist	\$4.98	0.0		\$0	13.78	\$0
C. Propane	\$7.87	0.0		\$0	14.16	\$0
D. Demand	\$108.60	1.8	кW	\$195	11.70	\$2,287
E. Other						40.400
F. Total				\$548		\$6,408
3. Non Energy	Savings (+) or	Cost (-):		****		
A. Annual Rec	urring (+/-)			\$212		
	actor (Table A)				11.12	
	Savings/Cost (3A x 3A1)				\$2,359
B. Non Recurr	ing Savings (+)	or Cost (-)				
	O-viene (1)	Veenef		Discount	Discounted Sav-	
Item	Savings(+)	Year of				
	Cost(-)(1)	Occur. (2)		Factor(3)	ings(+)Cost(-)(4)	
a.						
b.				-		
C.						
d. Total						
C Total Non E	nergy Discounte	ed Savings (3A2+	3B0	d4)	\$2,359	
		3A+(3Bd1/Econo	mic	Life)):	3.6	Years
	scounted Saving				\$8,767	
•	nvestment Ratio	•			3.16	
7. Adjusted Int	ternal Rate of Re	eturn (AIRR):			12.30%	

ECO D4 Part D

Location:		ggett, California	Region No. 4		oject No. scal Year FY95	
Project Title:	ECIP Facility El	nergy Improvemen	ns ghting with Fluoresc			
		ce incandescent Li	grung with Fluoresc Economic Life: 1	5 VEARS Pro	eparer: KELLER & GANN	ION
Analysis Date:	June 1993		Economic Life.	S IEARO ITE	epaier. NELLEN & GANN	OIV
1. Investment C	osts					
A. Construction			\$5,029			
B. SIOH			\$277			
C. Design Cost			\$302			
D. Total Cost (1			\$5,607			
E. Salvage Valu		guipment		\$ 0		
F. Public Utility	_			(\$465)		
G. Total Investr						
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		•	•		
O Charact Carrie	ere (+\/Coot(\)					
2. Energy Savir Date of NISTIR	85-3273-X Used	for Discount Fact	ors: October 1992			
				D '	Ditd	
Energy	Cost	Saving	Annual \$	Discount	Discounted	
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)	
A. Elec.	\$21.84	24.9	\$543	11.70	\$6,354	
B. Dist	\$4.98	0.0	\$0	13.78	\$0	
C. Propane	\$7.87	0.0	\$0	14.16	\$0	
D. Demand	\$108.60	3.5 kV	V \$380	11.70	\$4,451	
E. Other						
F. Total			\$924		\$10,805	
3. Non Energy	Savings (+) or	Cost (-):				
			#04.0			
A. Annual Recu			\$219	44.40		
(1) Discount Fa		24244		11.12	¢ 0.400	
(2) Discounted	Savings/Cost (3A x 3A1)			\$2,438	
B. Non Recurrie	ng Savings (+)	or Cost (-)				
Item	Savings(+)	Year of	Discount	Discounted Sav-		
item	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)		
	,,,,					
a.						
b.			-			
C.						
d. Total						
C Total Non Er	nergy Discounte	d Savings (3A2+3	Bd4)	\$2,438		
4. Simple Pavb	ack 1G/(2F3+3	A+(3Bd1/Econom	ic Life)):	4.5	Years	
	counted Saving		**	\$13,243		
	vestment Ratio			2.58		
	ernal Rate of Re			10.77%		

ECO D4 Part E

Location:		ggett, California		Region No. 4		Project N Fiscal Ye		
Project Title:		nergy Improvem			ont Bort E 250\			
		ce incandescent	Ligi	nting with Fluoreso Economic Life:			z/16 : KELLER &	GANNON
Analysis Date:	June 1993			Economic Life.	15 TEARS	riepaiei	. KELLER 6	GANNON
1. Investment C	Costs							
A. Construction				\$3,900				
B. SIOH	, 0000			\$214				
C. Design Cost	•			\$234				
D. Total Cost (1				\$4,348				
•	ue of Existing E	quipment			. \$0			
	Company Reba				(\$500)			
	ment (1D-1E-1F)						\$3,848	
	ì							
2. Energy Savir	ngs (+)/Cost(-):			0.1-11000				
Date of NISTIR	85-3273-X Used	d for Discount Fa	acto	rs: October 1992				
Energy	Cost	Saving		Annual \$	Discount	Di	scounted	
Source	\$/MTBU/(1)	MBTU/YR(2)		Savings(3)	Factor(4)	Sa	vings(5)	
ocaroc	4,,	,(_,		3 ()	()			
A. Elec.	\$21.84	26.8		\$586	11.70		\$6,857	
B. Dist	\$4.98	0.0		\$0	13.78		\$0	
C. Propane	\$7.87	0.0		\$0	14.16	•	\$0	
D. Demand	\$108.60	3.8	kW	\$411	11.70	'	\$4,803	
E. Other								
F. Total				\$997		-	\$11,660	
2 Non Energy	Sovings (±) or	Cost (-):						
3. Non Energy	Savings (+) or	OOSt (-).						
A. Annual Recu	urring (+/-)			\$208				
(1) Discount Fa					11.12			
	Savings/Cost (3A x 3A1)					\$2,316	
				•				
B. Non Recurri	ng Savings (+)	or Cost (-)						
Itome	Savings(+)	Year of		Discount	Discounted S	av-		
Item	Cost(-)(1)	Occur. (2)		Factor(3)	ings(+)Cost(-			
	Cosi(-)(1)	Occur. (2)		r actor(b)	11193(1)0031()(+)		
a.								
b.								
C.				-				
d. Total								
C Total Non Er	nergy Discounte	ed Savings (3A2	+3B	d4)	\$2,316			
		A+(3Bd1/Econ	omic	: Life)):	3.2	Ye	ears	
	scounted Saving				\$13,976			
	nvestment Ratio				3.63			
Adjusted Intelligence	ernal Rate of Re	eturn (AIRR):			13.34%	•		

ECO D4 Part F

Location:		iggett, California	•	1 No. 4		ject No. cal Year FY95	
Project Title:		nergy Improvement		th Eluorosc	ent, Part F - 300W to		
		ce incandescent		mic Life: 1		parer: KELLER & G.	ANNON
Analysis Date:	June 1993		EWIN	mic Lite.	15 ILANO ITE	parer. NEELEN a a.	A1414014
1. Investment C	Costs						
A. Construction			\$4	1,485			
B. SIOH				247			
C. Design Cost	t			269	•		
D. Total Cost (\$	5,000			
	ue of Existing E	quipment			\$0		
_	Company Reb				(\$575)		
G. Total Investi	ment (1D-1E-1F)				\$4,425	
O Francy Sovie	nge (±)/Cost(-):						
Date of NISTIR	ngs (+)/Cost(-): 85-3273-X Use	d for Discount Fa	ctors: Oct	ober 1992			
Date 5. 11. 5							
Energy	Cost	Saving	Annua	i \$	Discount	Discounted	
Source	\$/MTBU/(1)	MBTU/YR(2)	Saving	gs(3)	Factor(4)	Savings(5)	
	#04.04	444		6007	11 70	\$2 506	
A. Elec.	\$21.84	14.1		\$307	11.70	\$3,596 \$0	
B. Dist	\$4.98	0.0		\$0 \$0		\$0	
C. Propane	\$7.87	0.0		\$0 \$507	14.16		
D. Demand	\$108.60	5.5	kW	\$597	11.70	\$6,985	
E. Other				COO.4		¢10 E01	
F. Total				\$904		\$10,581	
3. Non Energy	Savings (+) or	Cost (-):					
A. Annual Rect			- 3	125 -	. 44.40		
(1) Discount Fa					11.12	#1 005	
(2) Discounted	Savings/Cost (3A x 3A1)				\$1,395	
B. Non Recurri	ing Savings (+)	or Cost (-)					
lte m	Savings(+)	Year of	Disco		Discounted Sav-		
	Cost(-)(1)	Occur. (2)	Factor	r(3)	ings(+)Cost(-)(4)		
9							
a. b.							
C.				-			
d. Total							
d. 10ta.							
C Total Non Er	nergy Discounte	ed Savings (3A2+	·3Bd4)		\$1,395		
4. Simple Pavb	ack 1G/(2F3+3	BA+(3Bd1/Econo	mic Life)):		4.3	Years	
	scounted Saving		,,		\$11,976		
	nvestment Ratio				2.71		
	ernal Rate of Re				11.14%		

ECO D4: REPLACE INCANDESCENT LIGTHTING WITH FLUORESCENT

This project would replace inefficient incandescent fixtures with efficient compact fluorescent fixtures or four-foot fixtures with electronic ballasts and T8 lamps. Replacements analyzed are shown in the table on the following page.

The proposed retrofits are described as follows:

Retrofits

Replace existing 60-100W surface-mounted incandescent lamps with

A, B & C

13W/5T4 to 18W/8T4 compact fluorescent lamps.

Retrofit D

Retrofit existing recessed incandescent downlight (150W lamp) with fluorescent ballast and socket adapter for 26W/8T4 quad lamp.

Retrofits E & F Replace existing suspended incandescent fixture (250-300W lamps) with industrial pendant-mounted fluorescent fixture containing 2-F32/T8 lamps

and electronic ballast.

Additional assumptions are as follows:

- 1. Hours of lamp operation based on field survey data.
- 2. Annual usage savings = (No. Fixtures) x (kW savings per fixture) x (operating Hrs./Year)
- 3. Annual Usage Cost Savings = kWh x \$0.07454 (Year-round, daytime average rate)
- 4. Annual O & M Cost = (Operating Hrs./Year) x [(Relamp Cost Exist / Mean Life Exist) (Relamp Cost Retrofit/Mean Life Retrofit)]
- 5. LCC Savings = Annual O&M Cost Savings x 11.12 +

Annual kWh Cost Savings x 11.70 + Annual kW Cost Savings x 11.70

Where Annual kW Cost Savings = kW Savings x \$108.60

6. Construction Cost Estimate

Bare costs are estimated based on "Means Construction Cost Estimating Guide 1993". Results are provided on the attached cost estimating forms.

Construction cost is determined by applying the following cumulative adders:

General Conditions:

8.0%

Estimating Contingency:

10.0%

Contractor's Overhead and Profit:

30.0%

Bond:

1.0%

Total Cost is determined by adding the following separate factors of the construction cost:

Supervision, Inspection and (Government) Overhead (SIOH):

5.5%

Allowance for Design Services:

6.0%

Investment is the Total Cost less the PG&E Rebate for the retrofit.

ECO D4 REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT

Data and Assumptions

ncande	Existing Incandescent Lamps	Lamps		Replaceme	ent Fluo	eplacement Fluorescent Lamps		Economic Screening Analysis	Screen	iing Ana	lysis			
Retrofit 1	Total	Mean	Relamping	Retrofit	Total	Mean	Relamping	Demand Labor	Labor	Matri	Total	PG&E	Total	Breakeven
Designation L	Lamp	Life 1	Cost	Lamp	Lamp	Life 2	Cost	Saving	Cost	Cost	Cost	Rebate	Invest-	Operating
>	Watts	(Hours)	(\$)	Type	Watts	(Hours)	(\$)	(kW)	(\$)	(\$)	(\$)	(\$)	ment (\$)	ment (\$) Hrs/Year
	8	1,000	1.50 + 1.50 Labor	13W/5T4	17	10,000	10.00 + 3.00 Labor	0.043	\$35	\$40	\$130	\$15	\$115	1,070
_	75	750	1.50 + 1.50 Labor	18W/7T4	25	10,000	10,00 + 3.00 Labor	0.05	\$35	\$40	\$130	\$15	\$115	825
	90	750	2.00 + 1.50 Labor	18W/7T4	25	10,000	10.00 + 3.00 Labor	0.075	\$35	\$40	\$130	\$15	\$115	190
_	150	750	2.40 + 1.50 Labor	26W/8T4	37	10,000	15.00 + 3.00 Labor	0.113	\$44	\$60	\$181	\$15	\$166	220
	250	750	2.75 + 1.50 Labor	2-F32/T8	61	20,000	8.00 + 5.20 Labor	0.189	\$50	\$75	\$217	\$25	\$192	0
	300	750	4.45 + 1.50 Labor 2-F	2-F32/T8	61	20,000	8.00 + 5.20 Labor	0.239	\$50	\$75	\$217	\$25	\$192	0

1. Total Cost = (Labor + Material) $\times 1.08 \times 1.30 \times 1.01 \times 1.10 \times 1.115$

Breakeven Operating = Hours per Year

Total Investment - (kW Savings x \$108.60 x 11.70)
(kW Savings x \$0.07454 x 11.70) + [(Relamp \$ / Mean Life 1 - Relamp \$ / Mean Life 2) x 11.12]

3. Total Investment = Total Cost - PG&E Rebate

Beakeven operating hours per year represent the minimum required operating hours per year for the proposed retrofits to be economically justified. 4.

SUMMARY OF ECO D-4: REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT

ECO	SUMM	ARY OF EC	SUMMARY OF ECO D4 ANALYSES	SES								
No.	ш	Energy Savings	ings			O&M		LCC Savings Construction	Total Cost	Rebate	Investment	SIR
	Fxtrs	kWH/Yr	kWH/Yr kW Demand Use	Use \$/Yr	Demand \$/Yr	\$/Yr	€9	φ.	€	₩	€	
A: 60W Savings	181	22,623	7.8	\$1,686	\$845	\$894	\$39,564	\$21,175	\$23,610	\$2,715	\$20,895	1.89
B: 75W Savings	Ø	208	0.1	\$16	\$11	\$11	\$433	\$234	\$261	\$30	\$231	1.88
C: 100W Savings	24	4,725	1.8	\$352	\$195	\$212	\$8,767	\$2,808	\$3,131	\$360	\$2,771	3.16
D: 150W Savings	3	7,286	3.5	\$543	\$380	\$219	\$13,243		\$5,607	\$465	\$5,142	2.58
E: 250W Savings	20	7,862	3.8	\$586	\$411	\$208	\$13,976	\$3,900	\$4,348	\$500	\$3,848	3.63
F: 300W Savings	23	4,124	5.5	\$307	\$597	\$125	\$11,976		\$5,000	\$575	\$4,425	2.71
TOTALS	281	46,828	22.5	\$3,491	\$2,439	\$1,671	\$87,960		\$41,957	\$4,645	\$37,312	2.36

ECO D-4 REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT: SUMMARY OF TOTAL PROJECT PER BUILDING

Fac	SIR > 1.0 D4A	4A	SIR >	SIR > 1.0 D4B	SIR >	SIR > 1.0 D4C	SIR	SIR > 1.0 D4D	SIR	SIR > 1.0 D4E	SIR >	SIR > 1.0 D4F	SIR > 1	SIR > 1.0 D4 AII	
Š.	Energy Savings kWH/Y kW Den	ngs Demand	Energy i kWH/Y	Savings Energy Savings kW Deman	ਰ	Energy Savings Energy 8 KWH/Y KW Demand KWH/Y	Ener d kWH	Energy Savings Energy KWH/Y KW Demand KWH/Y	Enel	Energy Savings kWH/Y kW Demar	Energ nd kWH/	Savings Energy Savings Energy Savings kW Demand kWH/Y kW Demand kWH/Yr kW Demand	Energy Savings d kWH/Yr kW De	Savings kW Dema	pu
P 80	•	'	'		86	3 0.2						•	86	0	0.2
P 81	1	'	'								- 783	3 4.8	783	4	8.4
T 120	1,803	0.4	•		. 349	9 0.1		•			- 3,341	1 0.7	5,493	-	Si
T 121	250	0.1	•		218	3 0.1		•					469	O	Ø
T 127	2,892	0.0	•	·	3,123	3 1.0	_	1		•	•	•	6,016	_	O,
P 128	6,887	2.2	•	·						•			6,887		2.2
T 156	80	0.0	•							•			. 80	0	0.0
S 197	1,046	9.0	•	·				•					1,046		9.0
P 205	429	0.1	'					•	,				429	U	0.1
P 207	413	0.1	,							,			413	Ü	0.1
P 208	413	0.1	•					1				1	413		0.1
P 209	1,831	1.7	'					,				•	1,831	_	7.
P 229	413	0.1	'						,	•			413	Ü	0.1
P 230	413	0.1	'	·			,	,	,	,			413		0.1
S 238	•		•	-			- 7,286	3.5	ın			•	7,286		3.5
P 252	83	0.0	•						- 3,538	38 1.	7	,	3,628		1.7
P 256	•	•	208	0.1				,		393 0.2	2		. 601		0.3
P 259	89	0.0	•					1	- 3,931	_	<u>ත</u>	•	4,021	_	o.
S 283	•	•	•		936	3 0.5	10		,	1		•	. 936		0.5
S 291	161	0.1	,			•		,		,	,		. 161	_	0.1
P 295	5,409	1.2	•						1	•	•	•	5,409	•	2
TOTALS	22,623	7.8	208	0.1	4,725	5 1.8	3 7,286	3.5	5 7,862	62 3.8	8 4,124	4 5.5	46,828	22.5	n)

ECO D-4 REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT

Fac	¥: 60	W to 13W,	A: 60 W to 13W/514 Savings									
No.		Energy Savings	vings			0&M	LCC Savings	LCC Savings Construction	Total Cost	Rebate	Investment	SIR
	Fxtrs	KWH/Yr	kWH/Yr kW Demand	Use \$/Yr	Demand \$/Yr	\$∕₹	₩.	₩	₩	₩.	₩	
T 120	თ	1,803	0.4	\$134		\$71.29	\$2,857		\$1,174	\$135	\$1,039	2.75
T 121	8	250	0.1	\$19	\$	\$9.90	\$438	\$234	\$261	\$30	\$231	1.90
T 127	2	2,892	0.9	\$216		\$114.35	\$4,942		\$2,739	\$315	\$2,424	
P 128	20	6,887	2.2	\$513	\$233	\$272.27			\$6,522	\$750	\$5,772	
T 156	-	80	0.0	\$6	\$5	\$3.18			\$130	\$15	\$115	
S 197	13	1,046	9.0	\$78	\$61	\$41.37		\$1,521	\$1,696	\$195	\$1,501	1.39
P 205	က	429	0.1	\$32	\$14	\$16.97			\$391	\$45	\$346	
P 207	က	413	0.1	\$31	\$14	\$16.34			\$391	\$45	\$346	
P 208	က	413	0.1	\$31		\$16.34			\$391	\$45	\$346	
P 209	39	1,831	1.7	\$137		\$72.40			\$5,087	\$585	\$4,502	
P 229	ဗ	413	0.1	\$31		\$16.34			\$391	\$45	\$346	
P 230	က	413	0.1	\$31		\$16.34			\$391	\$45	\$346	
P 252	-	89	0.0	25		\$3.54			\$130	\$15	\$115	
P 259	-	89	0.0	2\$		\$3.54			\$130	\$15	\$115	
S 291	2	161	. 0.1	\$12	\$6	\$6.36		•	\$261	\$30	\$231	
P 295	27	5,409	1.2	\$403	\$126	\$213.86	\$8,571	\$3,159	\$3,522	\$405	\$3,117	2.75
Totals	181	22.623	7.8	\$1,686	\$845	\$894	\$39.564	\$21.175	\$23.610	\$2,715	\$20,895	1.89

	SIR		1.88
	Investment	₩	\$231
	Rebate	₩	\$30
	Total Cost	€	\$261
	onstruction	€	\$234
	O&M LCC Savings Construction	₩.	\$433
	08M	\$∕₹	\$11 \$11.23
		Demand \$/Yr	\$11
		Use \$/Yr	\$16
75W to 18W/7T4 Savings	avings	kW Demand	0.1
to 18W/7	Energy Savi	kWH/Yr	208
B: 75W	Ш	Fxtrs	2
Fac	No.		P 256

ECO D-4 REPLACE INCANDESCENT LIGHTING WITH FLUORESCENT

Energy Savings Fxtrs kWH/Yr kW Demand Use \$YYr Demand \$YYr \$Yr \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	Fac	C: 10	C: 100W to 18W/7T4 Savings	4 Savings									
Fxtrs WWH/Yr KW Demand Use \$Yr Sept 84.41 \$421 \$551 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$351 \$352 \$3147 \$3177 \$3172	Š.		Energy Saving	st			O&M		Construction	Total Cost	Rebate	Investment	SIR
3 98 0.2 \$7 \$24 \$4.41 \$421 \$351 \$351 \$177 \$17			KWH/Yr KV	V Demand	Use \$/Yr			Ф	€	₩	₩	₩	
1 349 0.1 \$26 \$8 \$15.69 \$574 \$117 1 218 0.1 \$16 \$8 \$9.00 \$395 \$117 13 3,123 1.0 \$233 \$1.06 \$140.19 \$355.22 \$1,521 6 936 0.5 \$70 \$49 \$40.20 \$1,855 \$1,521 6 936 0.5 \$70 \$49 \$42.02 \$1,855 \$1,521 24 4,725 1.8 \$352 \$196 \$212 \$8,767 \$2,808 Energy Savings Extra kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$5 Extra kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$5 Extra kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$5 9 3,538 1.7 \$264 \$185 \$93.72 \$6,289 \$1,755 10 3,931 1.9 \$293 \$205 \$104.14 \$5,988 \$1,3976 Energy Savings Fri 300W to 2-F32/T8 Savings Fri 300W to 2-F32/T8 Savings Energy Savings Fri 300W to 2-F32/T8 Savings Fri 300W to 2-F32/T8 Savings Can 7,862 4 \$586 \$411 \$208 \$13,976 \$3,900 FAXE KWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$7/Yr \$5 Fri 300W to 2-F32/T8 Savings Fri 300W to 2-F32/T8 Savings Fri 500W to 2-F32/T8 Savings Fri 50	P 80	က	86	0.2	\$7		\$4.41	\$421	\$351	\$391	\$45	\$346	1.21
13 3,123 1.0 \$233 \$106 \$140.19 \$5,522 \$1,521 \$6 \$140.19 \$5,522 \$1,521 \$6 \$1,002	T 120	-	349	0.1	\$26	\$	\$15.69	\$574	\$117	\$130	\$15	\$115	4.98
13 3,123 1.0 \$233 \$106 \$140.19 \$5,522 \$1,521 \$702 \$24 4,725 1.8 \$352 \$195 \$212 \$8,767 \$2,808 \$702 \$24 4,725 1.8 \$352 \$195 \$212 \$8,767 \$2,808 \$702 \$24 4,725 1.8 \$352 \$195 \$212 \$8,767 \$2,808 \$702 \$24 4,725 1.8 \$352 \$195 \$212 \$8,767 \$2,808 \$702 \$20 \$7,286 3.5 \$5,029 \$213,243 \$5,029 \$213,243 \$5,029 \$214 \$2 \$20 \$1,755 \$20 \$2,209 \$2,1755 \$20 \$20 \$2,209 \$2,1755 \$20 \$20 \$2,209 \$2,1755 \$20 \$20 \$2,209 \$2,1755 \$20 \$20 \$2,209 \$2,1755 \$20 \$2,209 \$2,209 \$2,1755 \$20 \$2,209	T 121	-	218	0.1	\$16	\$8	\$9.80	\$395	\$117	\$130	\$15	\$115	3.45
6 936 0.5 \$70 \$49 \$42.0 \$1,855 \$702 24 4,725 1.8 \$352 \$195 \$212 \$8,767 \$2,808 D: 150W to 26W/8T4 Savings	T 127	13	3,123	0.1	\$233	\$106	\$140.19	\$5,522		\$1,696	\$195	\$1,501	3.68
D: 150W to 26W/8T4 Savings	S 283	ဖ	936	0.5	\$70	\$49	\$42.02	\$1,855		\$783	\$30	\$693	2.68
D: 150W to 26W/8T4 Savings Energy Savings Fxtrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	Totals	24	4,725	6 .	\$352	\$195	\$212	\$8,767	\$2,808	\$3,131	\$360	\$2,771	3.16
D: 150W to 26W/8T4 Savings													
Fxtrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr	Fac	D: 15(0W to 26W/8T	4 Savings									
E: 250W to 2-F32/T8 Savings Fxtrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$/260 \$1,250 \$1,250 \$1,250 \$1,250 \$1,755 \$1,250 \$1,755 \$1,000 \$1,	ŏ		Energy Saving	gs V Domond	6	4 V & Passage		LCC Savings	Construction	Total Cost	Rebate	Investment	SIR
E: 250W to 2-F32/T8 Savings Ernergy Savings Fxtrs KWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$/Yr \$/Yr \$/1755 9 3,538 1.7 \$264 \$185 \$93.72 \$6,289 \$1,755 10 3,931 1.9 \$293 \$205 \$104.14 \$6,988 \$1,950 20 7,862 4 \$586 \$411 \$208 \$13,976 \$3,900 Fxtrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$/\$ \$3,900 Fxtrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$/\$ \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 3 3,341 0.7 \$249 \$710,166 \$4,955 \$5.85		LXILS	KVVH/TF KI	v Demand	ose a/ 11	Dernario */ 11		9	9	9	9	9	
E: 250W to 2-F32/T8 Savings Extrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$/828 \$1,755 9 3,538 1.7 \$264 \$185 \$93.72 \$6,289 \$1,755 10 3,931 1.9 \$293 \$205 \$104.14 \$6,988 \$1,755 20 7,862 4 \$586 \$411 \$208 \$13,976 \$3,900 E: 300W to 2-F32/T8 Savings Extrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$ \$ \$ \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 7.31 6.5 \$249 \$577 \$1.05 \$4,955 \$585	S 238	31	7,286	3.	\$543	\$380		\$13,243	\$5,029	\$5,607	\$465	\$5,142	2.58
Exercise Savings Fxtrs kWH/Yr kW Demand Use \$/Yr Demand \$\frac{4}{8}\triangle \$\frac{4}{8}\		10.1	FOOL O THING		-					-			
Extrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	rac.	E. 25	UW to 2-F32/1	s savings					•	1			
Fxtrs kWH/Yr kWDemand Use \$/Yr Demand \$/Yr \$/Yr \$	Š		Energy Savino	Js.					Construction	Total Cost	Rebate	Investment	SIR
9 3,538 1.7 \$264 \$185 \$93.72 \$6,289 \$1,755 1 \$10.41 \$699 \$1,755 1 \$10.41 \$699 \$1,755 1 \$10.41 \$699 \$1,755 1 \$10.41 \$6,988 \$1,950 \$1.950		Fxtrs	kWH/Yr k	V Demand	Use \$/Yr			€9	↔	€	↔	₩	
1 393 0.2 \$29 \$21 \$10.41 \$699 \$195 10 3,931 1.9 \$293 \$205 \$104.14 \$6,988 \$1,950 20 7,862 4 \$586 \$411 \$208 \$13,976 \$3,900 F: 300W to 2-F32/T8 Savings Fxtrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$/Yr \$ \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 6.07 \$6	P 252	6	3,538	1.7	\$264				\$1,755	\$1,957	\$225	\$1,732	3.83
10 3,931 1.9 \$293 \$205 \$104.14 \$6,988 \$1,950 20 7,862 4 \$586 \$411 \$208 \$13,976 \$3,900 E: 300W to 2-F32/T8 Savings Fxtrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$ \$700 \$20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 7.83 6.249 \$78 \$101.66 \$4,955 \$585	P 256	-	393	0.2	\$29		\$10.41	\$699		\$217	\$25	\$192	3.63
20 7,862 4 \$586 \$411 \$208 \$13,976 \$3,900 F: 300W to 2-F32/T8 Savings Energy Savings Extrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$/Yr \$ \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 3 3,341 0.7 \$249 \$78 \$101.66 \$4,955 \$585	P 259	10	3,931	1.9	\$293				\$1,950	\$2,174	\$250	\$1,924	3.63
F: 300W to 2-F32/TB Savings Energy Savings Extrs kWH/Yr kW Demand Use \$/Yr Bemand \$/Yr \$/Yr \$/Yr \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	Totals	20	7,862	4	\$586	\$411	\$208	\$13,976	\$3,900	\$4,348	\$200	\$3,848	3.63
F: 300W to 2-F32/TB Savings Energy Savings Energy Savings Extrs kWH/Yr kW Demand Use \$/Yr \$/Yr \$/Yr \$/Yr \$/Yr \$/\$ \$ 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 20 783 6.495 \$585													
Extrs kWH/Yr kW Demand Use \$/Yr Demand \$/Yr \$/Yr \$/Yr \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	Fac	F: 300	JW to 2-F32/T	8 Savings									
Extrs kWH/Yr kW Demand Use \$/Yr \$/Yr \$ \$ \$ 20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 3 3,341 0.7 \$249 \$78 \$101.66 \$4,955 \$585 00 4.43 6.6 6.90 6.10 6.10 6.10 6.10	Š.	_	Energy Savin _ε	3s			O&M	LCC Savings	Construction	Total Cost	Rebate	Investment	SIR
20 783 4.8 \$58 \$519 \$23.83 \$7,021 \$3,900 3 3,341 0.7 \$249 \$78 \$101.66 \$4,955 \$585		Fxtrs	KWH/Yr K	V Demand	Use \$/Yr	Demand \$/Yr		€9	↔	€9	₩	\$	
3 3,341 0.7 \$249 \$78 \$101.66 \$4,955 \$585	P 81	20	783	4.8	\$58			\$7,021	\$3,900	\$4,348	\$200	\$3,848	1.82
73 4 104 E 6207 \$507 \$125 \$11 076 \$4.48E	T 120	က	3,341	0.7	\$249				\$585	\$652	\$75	\$577	8.58
23 4,145 5.0 45.1 45.2 41,145.0	Totals	23	4,124	5.5	\$307	\$597	\$125	\$11,976	\$4,485	\$5,000	\$575	\$4,425	2.71

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

ECO D8

Location: Project Title: I	Fort Hunter Ligge ECIP Facility Energ		Region No. 4			Project No. Fiscal Year FY95
Analysis Date:			Economic Life:	20	YEARS	Preparer: KELLER & GANNON
1. Investment			•			
A. Construction	n Costs		\$55,515	_		
B. SIOH			\$3,053			
C. Design Cos	st		\$3,331			
D. Total Cost	(1A+1B+1C)		\$61,899	•		
	lue of Existing Equ	ipment			\$0	
	y Company Rebate				\$0	_
	tment (1D-1E-1F)					\$61,899
2. Energy Sav Date of NISTI	rings (+)/Cost(-): R 85-3273-X Used f	or Discount Factors: O	ctober 1992	•		
Energy	Cost	Saving	Annual \$		Discount	Discounted
Energy Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)		Factor(4)	Savings(5)
A. Elec.	\$21.84	47	\$1,018		14.53	\$14,788
B. Dist	\$4.98		\$0		17.63	\$0
C. Propane	\$7.87		\$0		18.59	\$0
D. Demand	\$108.60	2.28 kW	\$247		14.53	\$3,593
E. Other						
F. Total			\$1,265	=		\$18,381
3. Non Energy	/ Savings (+) or Co	ost (-):	•			
A. Annual Red	curring (+/-)		\$6,480			
	actor (Table A)			-	13.59	
	d Savings/Cost (3A	x 3A1)				\$88,063
B. Non Recur	ring Savings (+) or	Cost (-)				
Item	Savings(+)	Year of	Discount		Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)		ings(+)Cost(-)(4)	
a.						
b.			•			
C.						
d. Total				=		
C Total Non E	nergy Discounted	Savings (3A2+3Bd4)			\$88,063	
		+(3Bd1/Economic Life)):		8.0	Years
	iscounted Savings				\$106,444	
6. Savings to	Investment Ratio (S	SIR) 5/1G:			1.72	
7. Adjusted In	ternal Rate of Retu	rn (AIRR):	•		6.86%	

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

ECO D-8, Part A

Location: Project Title: I	Fort Hunter Ligget ECIP Facility Energy	y Improvements	Region No. 4	latavina Daint	Project No. Fiscal Year FY95
Discrete Portion Analysis Date		Part A - Power Factor	Correction @ PG&E M Economic Life: 20	YEARS	Preparer: KELLER & GANNON
Allalysis Date	, duric root				,
1. Investment					
A. Construction	on Costs		\$45,781		
B. SIOH			\$2,518		
C. Design Co			\$2,747		
D. Total Cost	(1A+1B+1C)		\$51,046		
E. Salvage Va	lue of Existing Equ	ipment		\$0	-
	y Company Rebate			\$0	_
G. Total Inves	tment (1D-1E-1F)				\$51,046
2. Energy Sav	rings (+)/Cost(-):				
Date of NISTI	R 85-3273-X Used f	or Discount Factors: (October 1992		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
oource	ψ,ικτ 23/(1)		g-(-)	,	
A. Elec.	\$21.84		\$0.00	14.53	\$0
B. Dist	\$4.98		\$0.00	17.63	\$0
C. Propane	\$7.87		\$0.00	18.59	\$0
D. Demand	\$108.60	kW	\$0.00	14.53	\$0
E. Other					
F. Total			\$0.00		\$0
3 Non Energ	y Savings (+) or Co	ost (-):			
A. Annual Red			\$6,480		
	Factor (Table A)			13.59	
(2) Discounte	d Savings/Cost (3A	x 3A1)			\$88,063
B. Non Recur	ring Savings (+) or	Cost (-)			
	• • • •		Discount	Discounted Sav-	
ltem	Savings(+)	Year of	Discount		
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a.				-	
b.			-		_
C.					=
d. Total					-
C Total Non E	Energy Discounted	Savings (3A2+3Bd4)		\$88,063	
4. Simple Pay	/back 1G/(2F3+3A-	+(3Bd1/Economic Life	e)):	7.9	Years
	iscounted Savings		•	\$88,063	
	Investment Ratio (S			1.73	
	nternal Rate of Retu			6.87%	

Life Cycle Cost Analysis Summary Energy Conservation Investment Program (ECIP)

ECO D8, Part B

Location: Project Title:	Fort Hunter Ligg ECIP Facility Ene	ergy Improvements	Region No. 4		Project No. Fiscal Year FY95
Discrete Porti Analysis Date)8, Part B - Power Fa	ctor Correction @ Individual Economic Life: 2		Preparer: KELLER & GANNON
Allalysis Date	e. dune 1000				· · · · · · · · · · · · · · · · · · ·
1. Investment	Costs				
A. Construction	on Costs		\$9,733		
B. SIOH			\$535		
C. Design Co	st		\$584		
D. Total Cost	(1A+1B+1C)		\$10,853		
E. Salvage Va	alue of Existing E	quipment		\$0	_
F. Public Utili	ty Company Reba	ate		\$0	-
G. Total Inves	stment (1D-1E-1F))			\$10,853
2. Energy Sa	vings (+)/Cost(-):	d for Discount Factor	rs: October 1992		
Date of Mis II	IN 65-5275-X USE	d for Discount ractor	is. October 1002		
Energy	Cost	Saving	Annual \$	Discount	Discounted
Source	\$/MTBU/(1)	MBTU/YR(2)	Savings(3)	Factor(4)	Savings(5)
A. Elec.	\$21.84	46.6	\$1,018	14.53	\$14,788
B. Dist	\$4.98		\$0	17.63	\$0
C. Propane	\$7.87		- \$0	18.59	\$0
D. Demand	\$108.60	2.28	kW \$247	14.53	\$3,593
E. Other		-			
F. Total			\$1,265		\$18,381
3. Non Energ	y Savings (+) or	Cost (-):			
A. Annual Re	curring (+/-)		\$0		
	Factor (Table A)			13.59	
	ed Savings/Cost (3A x 3A1)			\$0
B. Non Recu	rring Savings (+)	or Cost (-)			
Item	Savings(+)	Year of	Discount	Discounted Sav-	
	Cost(-)(1)	Occur. (2)	Factor(3)	ings(+)Cost(-)(4)	
a.					
b.			-		
C.			-		
d. Total					
C Total Non I	Energy Discounte	ed Savings (3A2+3B	d 4)	\$0	
4. Simple Pay	yback 1G/(2F3+3	A+(3Bd1/Economic	: Life)):	8.6	Years
	Discounted Saving		• •	\$18,381	
	Investment Ratio	- '		1.69	
	nternal Rate of Re			6.78%	

Application of Power Factor Correction Capacitors is considered for two general conditions:

- 1. Installation at the main utility metering point, and
- 2. Intstallation at each individual offending motor.

Location at the main service point will reduce billing penalties only and not improve load capabilities of the distribution system. Installation at individual motors will free up system capacity be reducing the amount of magnetizing current drawn from the utility supply.

1. Installation at PG&E Metering Point - Savings Calculations

Data & Assumptions:

- A. PG&E rate schedule A-20 includes a 0.06% adjustment on the total billing for each 1% power factor differene from 85%. The adjustment is applied as a credit for power factors above 85% and as an additional charge for power factors below 85%.
- B. Average Main Post Billings: \$600,000 during summer period: \$400,000 during winter period.
- Average Power Factor:

Summer period - 82/83%

Winter period - 85/86%

Summer Peak Demand:

3,160 kW

Calculations:

Peak kVAR (Existing) = kW x Tan (arcCos 0.825)

= 3,160 kW x tan(34.41 degrees)

= 2,165 kVAR

B. Peak kVAR (Corrected to 95%)

= 3,160 kW x Tan (arcCos 0.95)

= 3,160 kW x Tan(18.19 degrees)

= 1,039 kVAR

Peak Correction Required

= 2,165 - 1,039 kVAR = 1,126 kVAR

Annual Savings*

 $= $600,000 \times 12\% \times (0.06\%)/(1\%PF)$

= \$4.320

+ \$400,000 x 9% x (0.06%)/(1%PF)

= \$2,160

Total Savings

= \$6,480/year

^{*} Assuming Correction to an average Power Factor of 95%

2. Installation of Power Factor Correction Capacitors @ Motor Loads

Annual kWh savings due to a reduction in motor circuit (I^2)R losses are estimated as follows (see notes):

HP	Max	Current	FLA@	Resistance	Loss	New	Savings
Rating	kVAR	Reduction	460V	Ohms/1000'	12R (W)	Loss	
		(%)				12R (W)	(Watts)
5	2.5	22	7.6	1.620	17	10	21
7.5	3	20	11	1.620	35	23	36
10	4	18	14	1.620	57	38	57
15	5	18	21	1.018	81	54	78
20	6	17	27	0.640	84	58	78
25	7.5	17	34	0.640	133	92	123
30	8	16	40	0.410	118	83	102
40	15	16	52	0.410	200	141	177
50	17.5	15	65	0.259	197	142	165
60	20	15	77	0.164	175	126	147
75	25	14	96	0.129	214	158	168

HP	Max	Current	FLA@	Resistance	Loss	New	Savings
Rating	kVAR	Reduction	460V	Ohms/1000'	1 ² R (W)	Loss	
		(%)				12R (W)	(Watts)
2	1	24	7.8	1.620	18	10	24
3	1.5	23	11	1.620	35	21	42
5	2.5	22	17.5	1.620	89	54	105
7.5	3	20	25	1.018	115	73	126
10	4	18	32	0.640	118	79	117
15	5	18	53	0.410	207	140	201
20	6	17	68	0.259	216	149	201
25	7.5	17	85	0.259	337	232	315
30	8	16	100	0.162	292	206	258
40	15	16	130	0.129	392	277	345
50	17.5	15	163	0.081	387	280	321
60	20	15	193	0.064	429	310	357
75	25	14	240	0.043	446	330	348

Assumptions:

- 1. kVAR values based on raising full load power factor to approx. 95%.
- 2. Motors assumed to be NEMA Design B, T-Frame, 1800 RPM.
- 3. Resistance of motor circuit assumes conductor sized at 125% of full load amps and a length of 180'.
- 4. Motor circuit savings in Watts = $[Exist (1^2)R New (1^2)R] \times 3$

SCREENING ANALYSIS - 460V MOTORS

HP	Max	Savings	Labor	Material	Total Invest.[1]	Breakeven [2]
Rating	kVAR	kW	Cost	Cost	w/ SIOH & Design	Oper. Hrs/Yr
5	2.5	0.021	\$95	\$270	\$588	24,490
7.5	3	0.036	\$95	\$280	\$604	14,130
10	4	0.057	\$95	\$300	\$636	8,940
15	5	0.078	\$120	\$320	\$708	7,020
-20	6	0.078	\$120	\$340	\$740	7,400
25	7.5	0.123	\$120	\$355	\$765	4,380
30	8	0.102	\$120	\$370	\$789	5,780
40	15	0.177	\$120	\$485	\$974	3,720
50	17.5	0.165	\$145	\$515	\$1,062	4,580
60	20	0.147	\$145	\$540	\$1,103	5,465
75	25	0.168	\$145	\$605	\$1,208	5,280

- [1] Investment = (Labor + Material) x 1.08 x 1.30 x 1.01 x 1.10 x 1.115
- [2] Breakeven Operating hours/year =

Total investment - (kW savings x \$108.60/kW x 13.59) (kW Savings x \$0.07454 x 14.53)

SCREENING ANALYSIS - 200V MOTORS

HP	Max	Savings	Labor	Material	Total Invest.[1]	Breakeven [2]
Rating	kVAR	kW	Cost	Cost	w/ SIOH & Design	Oper. Hrs/Yr
2	1	0.024	\$85	\$240	\$523	18,760
3	1.5	0.042	\$85	\$275	\$580	11,390
5	2.5	0.105	\$115	\$345	\$740	5,145
7.5	3	0.126	\$115	\$360	\$765	4,245
10	4	0.117	\$130	\$380	\$820	4,675
15	5	0.201	\$130	\$400	\$853	2,555
20	6	0.201	\$130	\$420	\$885	2,700
25	7.5	0.315	\$150	\$465	\$990	1,540
30	8	0.258	\$150	\$500	\$1,046	2,380
40	15	0.345	\$180	\$765	\$1,521	2,710
50	17.5	0.321	\$200	\$860	\$1,706	3,545
60	20	0.357	\$215	\$920	\$1,827	3,520
75	25	0.348	\$235	\$1,100	\$2,149	4,340

- [1] Investment = (Labor + Material) x 1.08 x 1.30 x 1.01 x 1.10 x 1.115
- [2] Breakeven Operating hours/year =

Total investment - (kW savings x \$108.60/kW x 13.59) (kW Savings x \$0.07454 x 14.53)

Life cycle cost analyses for motor installations meeting the minimum breakeven hours/yr are developed in the following spreadsheet.

CAPACITORS INSTALLED AT MOTOR LOAD

Bldg.	Supply		Return		Total	Usage	kWh
No.	HP	kW Saving	HP	kW savings	kW Savings	Hrs/Yr	Savings
205	25	0.315	10	0.117	0.432	5,840	2,523
207	25	0.315	10	0.117	0.432	5,840	2,523
208	25	0.315	10	0.117	0.432	5,840	2,523
210	10	0.117	-	-	0.117	8,760	1,025
229	25	0.315	10	0.117	0.432	5,840	2,523
230	25	0.315	10	0.117	0.432	5,840	2,523
-					2.277		13,639

Note: All motors are 200V

Annual Demand Savings = 2.277 kW x \$108.60/kW

= \$247

Annual Mil BTU Savings = 13,640 kWh x 0.003413 Mil BTU/kWh

= 46.6 Mil BTU

CONSTRUCTION COST E	STIM	IATE		June 19		Sheet OF		
Project EEAP Limited Energy Study Location Fort Hunter-Liggett, California				Project No.	Basis for	for Estimate		
					Code A (no design competed)			
Engineer-Architect								
Keller & Gannon Drawing No.		Estimato	NP.		Checked	Rv		
ECO-D8 PF Corr-PG&E Metering Po	int	RCL	,		BIH	u,		
Eco-port contract wetering to		uantity		Labor		Material		
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost	
1200 kVAR, 12 kV pad mounted					ļ			
capacitor bank including incoming line section and								
capacitor switching	-	LS	-	\$4,000	-	\$23,000	\$27,000	
Concrete pad & site work	-	LS	-	\$800	-	\$200	\$1,000	
Feeder to PG&E metering location	30	LF	\$25	\$750	\$20	\$600	\$1,350	
Quotation from LGE Electrical							-	
Sales, Inc. for ABB Brown Boveri	-							
equipment dated 2/18/93								
equipment dated 2/10/90	 							
Subtotal	 						\$29,350	
General Conditions @ 8%			-				\$2,348	
Subtotal							\$31,698	
Contractor OH & Profit @ 30%							\$9,509	
Subtotal							\$41,207	
Bond @ 1%							\$412	
Subtotal							\$41,619	
Estimating Contingency @ 10%							\$4,162	
Total Probable Construction Cost	ļ						\$45,781	
	-				-			
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CONSTRUCTION COST E	STII	MATE		Date Prepare June 19		Sheet	OF	
Project				Project No.	Basis for Estimate			
EEAP Limited Energy Study					Code A	(no design com	peted)	
Fort Hunter-Liggett, California								
Engineer-Architect					Ī			
Keller & Gannon								
Drawing No.		Estimate	or		Checked BIH	ву		
ECO-D8 PF Corr. @ individual mot	ors T a	RCL uantity	Γ	Labor		Material		
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	Total Cost	
4 kVAR Capacitor	5	EA	\$130	\$650	\$380	\$1,900	\$2,550	
7.5 kVAR Capacitor	6	EA	\$150	\$900	\$465	\$2,790	\$3,690	
Subtotal				\$1,550		\$4,690	\$6,240	
General Conditions @ 8%	 						\$499	
Subtotal	ļ						\$6,739	
Contractor OH & Profit @ 30%							\$2,022	
Subtotal							\$8,761	
Bond @ 1%			Ì				\$88	
Subtotal							\$8,849	
Estimating Contingency @ 10%	 	<u> </u>					\$885	
Total Probable Construction Cost							\$9,733	
								

ECIP Facility Energy	t, California Improvements
Oject.	
project number temporary:	program year 1995
, · · ·	category code 80000
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title	phone
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dfae name	date
title	phone
	autovon
engineer district	date
name	date
title	phone
	autovon
other (A-E) name	date
title	phone
	autovon
eviewed by:	
installation facility engineer	
name	date
title	phone
	autovon
pproved by:	
macom engineer	
name	date
title	phone

project development brochure, PDB-1

DA FORM 5020-R, Feb 82

facility

ECIP Facility Energy Improvements
Fort Hunter Liggett, Calif.

project coordinator for using service

functional requirements summary, PDB-1

1 of 9

DA FORM 5020-1-R, Feb 82

PROJECT OBJECTIVE

The objective of this project is to reduce energy consumption in cantonment area buildings by implementation of the following retrofits:

- a. Install batt insulation in the ceilings of 9 buildings.
- b. Install programmable controllers in 9 buildings.
- c. Insulate hot water heating and cooling water piping in 12 buildings.
- d. Install 24-hour programmable thermostats in 28 buildings.
- e. Replace space cooling equipment in 10 buildings with more efficient systems.
- f. Install automatic-draft damper controls on space heating equipment in 20 buildings.
- g. Convert dual-duct air-handling system to variable air volume in 5 barracks buildings.
- h. Replace boilers with high-efficiency units in 7 buildings.
- i. Insulate domestic hot water piping in 6 buildings.
- j. Insulate 16 domestic hot-water storage tanks in 13 buildings.
- k. Install self-metering lavatory faucets in 3 buildings; and install lavatory and shower flow restrictors in 2 buildings.
- 1. Install dishwasher heat recovery unit in Building 206.
- m. Install automatic-draft dampers on domestic hot water heaters in 3 buildings.
- n. Replace incandescent lighting fixtures with fluorescent fixtures in 9 buildings.
- o. Install automatic power factor correction equipment at utility metering point. Install power factor correction capacitors on 10 HP and larger motors in 6 buildings.

SPACE AND REQUIREMENTS

No additional space is required to implement this energy conservation project.

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functional requirements summary, PDB-1

DA FORM 5020-2-R, Feb 82

2 of 9

The buildings affected be implemented.	will consume less energy	than they would hav	e if this project h	ad not
oc implemented.				
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\1640310\INSERT.CUT				

A. SPECIAL CONSIDERATIONS

	ITEM	Required Not Requ	To Be Determin	Comment	Documen Attached
A-1	Cost estimates for each primary and supporting facility	R	D	0,	3
A-2	Telecommunications system coordination with USACC and authorization for exceptions	NR	D_		
A-3	Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permits, clearinghouse ecoordination, etc.)	NR			
A-4	Assignment of airspace	NR			
A-5	Economic analysis of alternatives	R	D		
A-6	Approval for new starts	NR	<u> </u>		
A-7	International balance of payments (IBOP) coordination with U.S. European command and NATO—overseas cost estimates and comparables (include rate of exchange used in estimates)	NR			
A-8	Impact on historic places—on site survey by authorized archeologist and coordination with state historic preservation officer and advisory council on historic preservation	NR			
A-9	Exceptions to established criteria		\vdash		
A-10	Coordination with various staff agencies (Provost Marshall-physical security, etc.)	_NR _NR	_		
A-11	Identification of related or support projects (so projects can be coordinated)		A		
A-12	Required completion date	R	A		

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

- TO BE DETERMINED Information needed but not currently evailable. Enter code for information source.
- COMMENT ATTACHED Significant information summarized or explained and attached.
- DOCUMENT ATTACHED Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

- A DEAG
- B Using Service
- C Construction Service
- D Designer
- E Other (Check Comments Attached and explain)

documentation checklist

DA FORM 5023-A-R, Feb 82

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C. ARCHITECTURAL & STRUCTURAL

		5 5	Ě	<u> </u>	<u> </u>
	ITEM	Required Not Requ	To Be Determin	Comment	Documen
C-1	Reconciliation with troop housing programs and requirements	NR			
C-Z	Evaluation of existing facilities (including degree of utilization)	NR			
C-3	Approval for removal and relocation of existing useable facilities	NR			
C-4	Evaluation of off-post community facilities	NR			
C-5	Storage and maintenance facilities (including nuclear weapons)	NR			
C-6	Coordination hospitals, medical and dental facilities with Surgeon General	NR		\vdash	
C-7	Coordination of aviation facilities with FAA	NR	_		
C-8	Coordination air traffic control and navigational aids with USACC	NR	 		
C-9	Tabulation of types and numbers of aircraft	NR	 		
C-10	Evaluation of laboratory, research and development, and technical maintenance facilities	NR		 	
C-11	Coordination chapels with Chief of Chaplains	NR	_		
C-12	Review food service facilities by USATSA	NR		 	
C-13	Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities				
C-14	Coordination postal facilities with U.S. Postal Service Regional Director	NR	 		<u> </u>
C-15	Laundry and dry cleaning facilities coordination with ASD(I&L)	NR	<u> </u>		<u> </u>
C-16	Tenant facilities coordination with installation where sited	NR			
C-17	Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item 8-4)	NR			
C-18	Analysis of deficiencies	NR_			
C-19	Consideration of alternatives	R	_P_		<u> </u>
C-20	Determination whether occupants will Include physically handicapped or disabled persons	_R	_D_		
C-21	As-build drawings for alterations or additions	NR			
C-22	Availability of Standard Design or site adaptable designs	R	<u> </u>		
	Other Architectural & Structural (List and number items)	NR_			
	-				

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A - DFAE

B - Using Service

C - Construction Service

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documentation checklist 5 of 9

DA FORM 5023-C-R, Feb 82

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

	ITEM	
D-1	Fuel considerations and cost comparison analysis	
D-2	Energy requirements appraisal (ERA)	
D-3 D-4	Conformance with DOD Energy Reduction requirements	
D-4	Evaluation of existing and/or proposed utility systems	
	Other Mechanical and Utility Systems (List and number items)	

Required or Not Required	Red	luired or Required
To Be • O C C C C C C C C C C C C C C C C C C	T O	Be ermined
	Atta	Comment Attached
	Atta	Document Attached

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- A DFAE
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- E Other (Check Comments Attached and explain)

documentation checklist

DA FORM 5023-D-R, Feb 82

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A. SPECIAL CONSIDERATIONS

	ITEM
A-1	Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages
A-2	Construction phasing requirements
A-3	Functional support equipment (mechanical, electrical, structural, and security) to be built in
A-4	Equipment in place and justification
A-5	Other equipment and furniture (O&MA, OPA) and costs
A-6	Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.)
A-7	Type of construction (permanent, temporary, semi-permanent)
8-A	Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement.
	Other special considerations (list and number items)

Required or Not Required	To Be • Determined	Comment Attached	Document Attached
NR R R NR NR NR NR	A D	Col	Doc
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- A DFAE
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- D Designer
- E Other (Check Comments Attached and explain)

technical data checklist

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DA FORM 5024-A-R, Feb 82

C. ARCHITECTURAL & STRUCTURAL

\equiv		ired	H ain	nent	ment
	ITEM	Required Not Requi	To Be Determine	Comment Attached	Document Attached
C-1	Vibration-producing equipment requiring isolation	R	D		
C-2	Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential)				
C-3	Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological)	NR NR			
C-4	Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing)	NR			
C.5	Designation and strength of units to be accommodated	NR	-		
C-6	Requirements and data for special design projects		_		
C-7	Unusual floor and roof loads (safes, equipment)	NR.	-		
C-8	Security features (arms rooms, vaults, interior secure areas)	_NR	-		
	Other Architectural & Structural (List and number items)	NR.	-	 	

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A - DFAE

B — Using Service

C - Construction Service

D - Designer

E - Other (Check Comments Attached and explain)

technical data checklist

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DA FORM 5024-C-R, Feb 82

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

	ITEM
D-1	Special mechanical requirements or considerations (elevator, crane, hoist, etc.)
D-2	Special peak usage periods and peak leveling techniques
D-3	Maintenance considerations (accessibility of equipment, compatibility with existing equipment)
D-4	Plumbing—availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas)
D-5	Heating—availability, general system type and characteristics (proposed and/or existing)
D-6	Ventilating, air condition/refrigeration—availability, general system type and characteristics (proposed and/or existing)
D-7	Electrical—availability, general system type and characteristics incl. airfield lighting, communication, etc. (proposed and/or existing)
D-8	 Water supply/waste treatment—availability, general system type and characteristics (proposed and/or existing)
D-9	Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.)
D-10	Solar energy evaluation
	Other Mechanical & Utility Systems (List and number items)

	Required or Not Required	To Be * Determined	Comment Attached	Document Attached
	NR NR R			
Į	NR			
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	NR			
	R	В		*
	R	В		
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A - DFA

B - Using Service

C - Construction Service

D - Designer

E — Other (Check Comments Attached and explain)

technical data checklist

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DA FORM 5024-D-R, Feb 82